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Railway
Mechanical Engineer

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July - 1935

Mechanical Division Holds Fourteenth Annual Meeting

First full-membership meeting since 1932 convenes at Hotel Congress, Chicago, to consider a program devoted strictly to committee reports

E. B. Hall
Chairman

THE fourteenth annual meeting of the Mechanical Division of the Operations and Maintenance Department, Association of American Railroads, was held on Wednesday and Thursday, June 26 and 27, at the Congress Hotel, Chicago. The meeting was called to order by Chairman E. B. Hall, general superintendent motive power and machinery, Chicago & North Western.

The program was confined strictly to the business of the association and there were no formal addresses. During the course of the meeting, however, Dean A. A. Potter of Purdue University, Roy V. Wright, editor of the *Railway Mechanical Engineer*, and L. W. Wallace, director of equipment research, A.A.R., were called upon for brief remarks. Mr. Wallace spoke in terms of high respect for past accomplishments of the Mechanical Division and expressed his appreciation for the help which the members have rendered him in his efforts toward the organization of the equipment research work of the association. Many specific questions and problems have already been submitted, he said, in many instances by the railways themselves. These problems are of such a nature that, in his opinion, they cannot be solved by any one person or agency, but that a definite procedure can be developed with the help of all parties interested which promises a solution of most of the important problems relating to equipment with which the railroads are now confronted.

The General Committee presented a detailed review of the important actions which it has taken on recommendations from the various standing committees, all of which were formally approved by vote of the members present. It recommended a change in the rules of order of the Division providing for the taking of letter ballots to conform with Article 18 of the plan of organization of the Association of American Railroads. The present rules of order of the Division require two-thirds of the votes cast to adopt a proposition submitted to letter ballot whereas the A.A.R. rules require an affirmative vote of member roads controlling a majority of

O. A. Garber
Vice-Chairman and Chairman-Elect

locomotives, passenger cars or freight cars, as the case may be.

In announcing that the effective date of the prohibition in Rule 3 against the acceptance of any cars equipped with arch bars in interchange has been advanced to January 1, 1938, the General Committee pointed out that there remained in service on January 1, 1935, 782,464 freight cars or 32.5 per cent of all interchange cars equipped with arch-bar trucks. It also reported that the joint committee, representing the Engineering, Mechanical and Purchases and Stores Divisions to consider the establishment of central or regional inspection bureaus, has recommended that such bureaus be not established but that the railroads arrange to inspect for each other on the basis of direct cost plus 10 per cent. This recommendation has been approved by the General Committee and sent to the executives of the member roads.

The General Committee also announced that the equipment painting section of the Mechanical Division has been abandoned and that a small committee of the Mechanical Division will be appointed to deal with matters pertaining to equipment painting.

New Officers Elected

O. A. Garber, chief mechanical officer, Missouri Pacific Lines, was elected chairman, and W. G. Black, vice-president, Chesapeake & Ohio, vice-chairman, to serve until June, 1936. The retiring chairman, E. B. Hall, general superintendent motive power and machinery, Chicago & North Western, and Mr. Garber, the retiring vice-chairman, were elected at the last annual meeting in 1932, thus having served one more than the regular term of two years, the rules of order of the division providing for the election of officers at the regular meeting in June of each even year. Mr. Hall was elected a member of the General Committee. J. A. Power, superintendent of motive power and machinery, Southern Pacific Lines in Texas and Louisiana, and H. B. Bowen, chief motive power and rolling stock, Canadian Pacific, were re-elected members of the General Committee to succeed themselves.

The Nominating Committee recommended that the rules of order of the division be amended to provide for a reduction in the membership of the General Committee from 16 to 12, including the chairman and vice-chairman.

Specifications for Materials

Your committee, during the past year, has reviewed all specifications within its charge and, acting by direction of the General Committee, has revised the greater number of them to bring them up to date or to include additional grades of material desired by some roads.

The object, as expressed by the General Committee, was to make the specifications acceptable to all members with a view to having them used in preference to specifications of individual roads. This is a difficult object to attain completely because of the continual change in requirements going on all the time under modern conditions. A railroad is of necessity compelled to change its specifications to meet the requirements of a new design and sometimes material is used which is experimental and not sufficiently tried out to warrant its being included in a standard specification. We have therefore endeavored to cover material used in interchange or material that is known from long use to be satisfactory and would request that members using these specifications and finding them inadequate in some respects for their needs, will at once advise the secretary their criticisms and suggestions for improvement so that the committee may benefit therefrom.

As explained in Circular D. V. 824, January 7, 1935, the specifications have been numbered and grouped according to kind of material to facilitate finding them in the Manual and designating them on orders.

These revisions were approved by letter ballot but subsequently there was a request from the manufacturers for a few changes in steel castings M-201 and in M-101 axles, M-102 and M-103 forgings and M-105 billets. These changes were slight and were reported to the secretary with request to take care of them in printing. This has been done; but since the action was taken after the letter ballot your committee requests that the usual motion for action on this report carry with it approval of the changes.

A revision of specifications for steel sheets and thin plates M-117-26, has been prepared after discussion with the manufacturers in which we have agreed as to tolerances with the exception of those on buckles which have been made to suit the requirements of the consumers.

[These specifications were submitted as M-117-35.—Editor.]

Your committee has before it consideration of specifications for bolts and nuts and a revision of specifications for rivets to agree with the recommendations of the American Standards Association. So far these specifications have not received official approval but it is expected that they will be available during the coming year.

The report was signed by: F. M. Waring (chairman), engineer tests, Penna.; T. D. Sedwick (vice-chairman), engineer tests, C. R. I. & P.; C. P. VanGundy, engineer tests, B. & O.; F. Zeleny, engineer tests, C. B. & Q.; H. G. Burnham, engineer tests, No. Pac.; J. C. Ramage, engineer tests, Southern; H. W. Faus, engineer tests, N. Y. C.; E. E. Chapman, engineer tests, A., T. & S. F.; A. G. Hoppe, engineer tests, C., M., St. P., & P.; H. P. Hass, engineer tests, N. Y., N. H. & H., and J. R. Jackson, engineer tests, Mo. Pac.

Discussion

F. H. Hardin, assistant to the president, New York Central, called attention to the large amount of work involved in reviewing all of the specifications and making extensive revisions to bring them up to date. He moved that a rising vote of thanks be given the committee, which was done. C. T. Ripley, chief mechanical engineer, Atchison, Topeka & Santa Fe, also commented on the comprehensive character of the work of the committee and supplemented Mr. Hardin's remarks, urging that the recommendations of the committee be adopted generally and put into use by all railroads; otherwise the committee's work will be largely nullified.

Action.—The report was accepted and the revised specifications, as well as new specifications, were ordered submitted to letter ballot.

Safety Appliances

Metal Running Boards.—Data from a number of roads giving results of observations of metal running boards in service are being analyzed and tabulated in preparation of a report on this subject.

Standardization of Geared Hand Brakes.—This committee has been furnished a copy of the minutes of the joint meeting of the committee on Standardization of Geared Hand Brakes, held at Chicago, April 18, 1935, and is cooperating with the Committee on Car Construction and the Committee on Brakes and Brake Equipment in reviewing the proposed recommendations and rules which will be incorporated in the report of the Committee on Brakes and Brake Equipment.

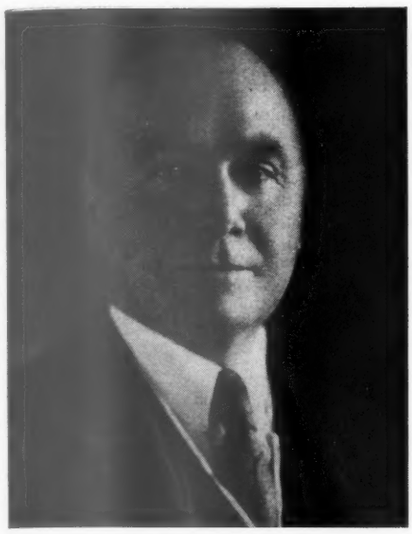
Automatic Train Line Connectors

Director of Automatic Train Line Connector Investigation, Harley A. Johnson, reports that laboratory tests have been completed on all connectors submitted, and these data are being analyzed and tabulated in preparation of report on the rack test. Report of laboratory tests will be closed as soon as possible. Mr. Johnson's progress report is as follows:

Mr. Johnson's Report

The investigation of automatic train line connectors has been continued in the laboratories of Purdue University during the past year. Reference is here made to the progress reports of the Director of Research at the annual meetings of the Mechanical Division for the years 1930 to 1932 and at the General Committee meetings of the Mechanical Division in June 1933 and 1934.

In the early part of this investigation, plans and specifications of automatic train line connectors were submitted by 51 different companies or individuals who are manufacturers or patentees of these devices. After careful study of the plans and specifications nine different devices were ordered for the laboratory tests. These devices were selected as representative of the various types of connectors; such as coupler supported or car body supported; wing type or pin and funnel type gathering devices; butt face ports, 45 deg. ports or side ports. Six freight and six passenger type connectors of each design were ordered for tests.



W. G. Black
Vice-Chairman-Elect

The following table shows the nine types of connectors ordered and the dates of completion of laboratory tests on the connectors delivered at Purdue University for this investigation.

Date Laboratory Tests Completed

Connectors ordered for laboratory tests	Freight type connector		Passenger type connector	
Robinson-wing type	February	1931	April	1932
Robinson pin and funnel type	February	1931	May	1933
Consolidated (American)	April	1931	December	1932
National	July	1931	(b) Not Delivered	
Roberts	September	1931	July	1934
Johnson	June	1932	April	1934
Cobb	(a) Not Tested		October	1934
McTaggart	(b) Not Delivered		(b) Not Delivered	
Workman-Robinson	(b) Not Delivered		(b) Not Delivered	

(a) Tests were made only on the Cobb passenger type connector.
(b) These connectors will not be tested since they were not delivered at Purdue University prior to January 1, 1934, which was the limiting date set by the General Committee of the Mechanical Division.

At the meeting of the Committee on Safety Appliances and the General Committee in June, 1933, it was decided that no more connectors would be received for tests after January 1, 1934, and also that the tests should be limited to connectors which can be used with the present coupler and draft rigging, and should not include devices which involve the design of a new coupler. This action was also approved by the joint committee on Automatic Train Line Connectors. Each company, from which connectors had been ordered, was advised of the limiting date for delivery of connectors by letter dated July 13, 1933. The freight and passenger connectors of the Automatic Train Pipe Connector Company (McTaggart connector) and the Workman Robinson Company, and the passenger type connector of the National Connector Company were not delivered at Purdue University and therefore were not tested. The Automatic Train Pipe Connector Company (McTaggart connector) requested an extension of the limiting date but as the order was placed with this company in 1931, the General Committee decided to re-affirm the action taken at the meeting of June 27, 1933, that all connectors to be included in the test must be delivered on or before January 1, 1934, and that connectors not received by that time will not be tested.

During the past year the Roberts and the Cobb passenger type connectors were installed on the impact test rack and submitted to a part of the tests specified in the schedule. After running a number of tests with the Roberts passenger type connector it was apparent that this connector as submitted was unsatisfactory. Representatives of the Roberts Connector Company felt that they could make it satisfactory by changing the tension of some of the springs and by making other minor adjustments which would not change the fundamental operation. Accordingly the tests were discontinued with the understanding that these changes would be made in the near future and the connector again submitted for tests.

Following discontinuance of tests with Roberts passenger type connector, the Cobb passenger connector was installed on the impact testing machine after making the necessary alterations in the machine to meet the requirements of this connector. The Cobb passenger type connector was installed on the test rack in advance of the Cobb freight type connector in order to save the time of testing the freight connector in case the passenger connector did not function properly. After making a number of tests with the Cobb passenger type connector it was apparent that its construction would not meet the requirements of satisfactory operation and the tests on this device were discontinued in October, 1934.

Following the discontinuance of the tests of the Cobb passenger type connector, the Roberts Connector Company was notified that we were ready to proceed with the tests on the Roberts passenger type connector as soon as they were in a position to resubmit it to us. Later on the Roberts Connector Company advised that they were not in a position to make the necessary changes and that they would not resubmit the passenger type connector for further tests.

During the past year some time has been given to the study of new designs of automatic train line connectors which have been submitted for consideration. During the periods when there were no connectors ready for test, some of the men were laid off while the others were used in working up the results of the tests and the preparation of a report. The report is now being put in final form and the results analyzed, and it is expected that the report will be ready for presentation to the General Committee and to the Joint Committee on Automatic Train Line Connectors about July 1st.

The Director has continued to make a monthly progress report to W. J. Patterson, Director of Bureau of Safety of the I. C. C., with copies to M. J. Gormley; Frank Walters or C. E. Denney, chairman, Joint Committee on Automatic Train Line Connectors; R. G. Henley, chairman, Committee on Safety Appliances; and V. R. Hawthorne, secretary, Mechanical Division. Representatives of the Bureau of Safety, I. C. C., the train service brotherhoods, the railroads, and manufacturers of devices being tested, have been present at various times during the conduct of the tests.

The report was signed by R. G. Henley (chairman), superintendent motive power, N. & W.; F. W. Hankins, (vice-chairman), chief motive power, Penna.; C. J. Bodemer, superintendent machinery, L. & N.; F. H. Hardin, assistant to president, N. Y. C.; J. Purcell, assistant to vice-president, A., T. & S. F., and J. J. Tatum, general superintendent car department, B. & O.

Action.—The report of the committee, including the progress report of the director of research on automatic train line connectors, was accepted.

Electric Rolling Stock

On account of continued general business conditions, no meetings were held during the year. The committee selected two subjects which it thought would be of interest in the handling of electric locomotives as follows:

1—Allowable Temperature rise for, and Effect of Heating on Motor Insulation.

Subcommittee: R. Beeuwkes, chairman, J. W. Sasser and J. H. Davis.

2—Advantages in the Use of Anti-Friction Bearings in Traction Motors and Main Journals of Multiple-Unit Cars and Elec-

V. R. Hawthorne
Secretary

tric Locomotives with Respect to Operation, Maintenance, and Conduction of Current Through Parts.

Subcommittee: W. S. H. Hamilton, chairman, A. L. Ralston and J. V. B. Duer.

The subcommittee handling the first subject found that a committee of the American Standards Association was working on the same matter and, not wishing to duplicate their work, it was decided to drop this subject.

In order to make a comprehensive and complete report on the second subject, it was thought by the subcommittee that the subject was of sufficient importance to require a more extensive investigation on the various railroads using anti-friction bearings in order to incorporate in the report their experience with these bearings on armatures, suspension and quill bearings on traction motors, and journal bearings on electric locomotives and MU cars. In this investigation the committee proposes to secure information and report on the following points:

1—Effect on starting friction.
2—Effect on schedules particularly as applied to MU trains.
3—Effect of propulsion current passing through the bearings.
4—Energy saving resulting from use of anti-friction bearings.
5—Relative cost of maintenance between plain and anti-friction bearings.

It is proposed to send out a brief questionnaire to a number of representative roads covering the above and ask for information and opinions on the various points outlined. The subcommittee will then be able to compile the data and present conclusions for consideration by the full committee. On account of present economic conditions and the importance of this subject, it is recommended that this be carried over as a subject for next year, which will enable us, we believe, to complete the study.

A resume of the new electric locomotives which have been placed in the New York-Washington passenger service has been prepared by J. V. B. Duer, electrical engineer of the Pennsylvania. We are giving this brief write-up in our report as we believe this will be of interest.

A tabulation of data on electric locomotives placed in service on the Pennsylvania for the year ending June, 1935 is also given. According to the information the committee has, no electric locomotives have been placed in service on other roads, either domestic or foreign, during the year in question.

Pennsylvania Electric Locomotives

By J. V. B. Duer, electrical engineer

Early in 1934, the Pennsylvania decided that for its through New York-Washington passenger service, more powerful locomotives than the P5 type, of which 64 were in service, would be desirable. During the spring and summer of 1934, two new types of locomotives were designed and one of each type was built. These were designated as classes GG1 and R1. After extensive tests during the fall of that year, the class GG1 was selected.

Simultaneously with the preparation of the two new designs, the cab of the P5 class was re-designed to give stream-lined contour and to provide a single central motorman's compartment at the middle of the locomotive. Twenty-eight of these modified engines have been completed and are in service.

Fifty-seven additional class GG1 locomotives are to be built, delivery having already started, and completion being expected early in the summer. This locomotive is of the articulated-truck type, each of the two coupled main trucks, or frames, including three pairs of driving axles and a four-wheel guiding truck. A stream-lined cab rests on center plates and spring pads on the two main frames. Cab strength is provided by two trusses, framed into the cab and extending between center plates. The cab frame structure is riveted but the side and roof sheets are welded, making a perfectly smooth exterior, without rivet heads. The heating boiler, transformer with allied apparatus, and two operating compartments, are in the central portion of the cab. Hoods at either end house oil and water tanks, blowers, etc., and support the pantographs.

The locomotive has six twin motors carried in the main frames, one over each driving axle. The wheels are driven through gears, quills, and a flexible spring drive. The continuous horsepower is 4,620 at the maximum operating speed of 90 m.p.h. An oil-insulated, forced-cooled transformer is used.

The coupled length of the locomotive is 79 ft., 6 in.; the rigid wheel base is 13 ft., 8 in.; the total weight is approximately 460,000 lb., with approximately 300,000 lb. on drivers.

As fast as these locomotives are completed they will be placed in passenger service and the older P5a locomotives with box cabs will be placed in freight service. This eliminates further construction of the class L6a freight locomotive originally contemplated.

The report was signed by: R. G. Henley (chairman), superintendent motive power, N. & W.; J. H. Davis, chief engineer electric traction, B. & O.; J. V. B. Duer, electrical engineer, Penna.; J. W. Sasser, superintendent motive power, Virginian; R. Beeuwkes, electrical engineer, C., M., St. P. & P.; W. S. H. Hamilton, equipment electrical engineer, N. Y. C., and A. L. Ralston, general mechanical superintendent, N. Y., N. H. & H.

Action.—The report was accepted.

Lubrication

This committee has held one meeting since the annual report was submitted in 1934. In connection with the recommendation that tests be conducted of various methods and devices for lubricating car journals to develop a method more satisfactory than the conventional waste lubricating practice; the General Committee instructed the Committee on Lubrication "to prepare a plan of procedure with estimate of cost and submit to the General Committee for authority to proceed."

The plan was prepared at meeting held November 23, 1934 and submitted to the General Committee. The General Committee took the following action at a meeting December 6, 1934.

"It was the opinion that the recommendation of the Committee on Lubrication of Cars and Locomotives for tests of various lubricating devices did not cover a large enough scope and did not include sufficient portions of the country to provide conclusive results. It was therefore decided that, instead of approving an appropriation for the tests as recommended, the members of the General Committee will carefully review these recommendations and develop what tests along these lines they would be willing to make and under what conditions—the tests to be made under the direction of the test departments of the member railroads and report submitted to the lubrication committee for review and analysis."

Partial reports from members of General Committee were received under date of May 2, 1935. Where tests are in progress results remain in abeyance pending further developments.

The chairman of this committee has continued to investigate and test a number of lubricating devices and methods with generally satisfactory results. These tests will be continued and complete report made when definite conclusions are reached.

The joint subcommittee composed of members from car construction and lubrication committees selected to consider "The Tolerances in Whole Axle and Journal Assembly" have submitted a report which is incorporated in the report of the car construction committee.

Journal Bearings

The new design of journal bearing developed by National Bearing Metals Corporation has been given trial application on a number of railroads. These bearings, however, have not yet been in service a sufficient length of time for the committee to recommend them for adoption as an alternative A. A. R. standard.

Cut-Back and Reclaimed Oils

A recommendation has been made to Committee on Specifications for Materials of a specification for blending or cut back oil.

The committee is of the opinion that there is no necessity for present Par. 7 of Specification for Reclaimed Car Oil, but if this paragraph is retained, the following should be included:

ASSOCIATION OF AMERICAN RAILROADS
MECHANICAL DIVISION
ELECTRIC ROLLING STOCK COMMITTEE
ELECTRIC LOCOMOTIVES PLACED IN SERVICE FOR THE YEAR ENDING JUNE 1935

	CONTINUOUS	COUNTRY	RAIL WAY	A.C. OR D.C. & FREQ.	CONTACT LINE VOLTS	GAUGE INCHES	YEAR IN SERVICE	NUMBER	TYPE OF SERVICE	AXLE CLASSIFICATION	METHOD OF DRIVE	DIMENSIONS INCHES: WHEEL DIAMETERS DRIVE	WHEEL DIAMETERS IDLER	LENGTH OVER ALL	RIGID WHEEL BASE	WEIGHTS THOUSANDS OF POUNDS: TOTAL	ON DRIVERS	PER AXLE	PIECE PARTS	ELECT. MATER.	1 HR. RATING: HP	MPH	TE 1000 LBS	CONTINUOUS RATING: HP	MPH	TE 1000 LBS	LBS PER HP	MAX SAFE SPEED MPH	MOTORS: NO.	TYPE	VOLTS	GEAR RATIO	REGEN. CONTROL	ROAD NO.	BUILDER: ELECT PARTS	BUILDER: MECH PARTS	WHEEL ARRGT.	CAB ARRGT.
S	N.A.	U.S.A.	P.R.R.	D.C. 60	11,000	56½	1934	5	Pass	C	Gear	62	—	378	152	457.0	457.0	57.33	—	—	730	12.4	22.1	570	15.9	13.5	276	25	3	1376	235	65/67	No.	4700-13 4704-8	W.E.&M.	P.R.R.	○○○	
S	"	"	"	"	"	"	1934	5	"	"	"	"	"	"	"	"	"	"	—	—	"	"	"	"	"	"	"	"	"	"	"	"	"	4700-17 4708-12	"	"	"	
"	"	"	"	"	"	"	"	10	"	"	"	"	"	"	"	"	"	"	—	—	"	"	"	"	"	"	"	"	"	"	"	"	"	4684 4693	A.H.& Cahoon	"	"	
"	"	"	"	"	"	"	1	Pass	2-C+C-2	Quill	"	57	36	854	164	475	303	50.5	—	—	—	—	—	4620	100	17.3	104	100	12	627	352	65/77	"	4800	G.E.Co.	B.L.H.	○○○○○○○○○	
"	"	"	"	"	"	"	1	"	2-D-2	"	"	62	"	776	278	402	230	57.5	—	—	—	—	—	5000	100	18.75	80.5	106	8	428	"	27/74	"	4895	W.E.&M.	BALDWIN	○○○○○○	
"	"	"	"	"	"	"	1	"	2-C-2	"	"	72	"	752	240						—	—	—	3720	63	22.3		96	6	4254	275	29/101	"	4700	W.E.M.Co.	P.R.R.	○○○○○○	

X REBUILT BBE HALF-UNITS

Apparatus.—A sieve of No. 325 mesh screen, preferably 3 in. in diameter secured to a copper cylinder; the cylinder to be not less than 1½ in. in depth.

Procedure.—A sample of oil to be tested 200 milliliters or ½ pint, at temperature 75 deg. F. minimum to be poured into the cylinder and allowed to remain until all the oil has passed through the 325 mesh screen. If any extraneous solids remain on the screen, oil will not be considered as meeting the specifications.

The subcommittee appointed to act with similar committee from Committee on Locomotive Construction has no report to make at this time.

The report was signed by G. W. Ditmore (chairman), master car builder, D. & H.; P. Maddox, superintendent car department, C. & O.; G. C. Hirsch, mechanical inspector, N. Y. C.; E. Von Bergen, general air brake, lubrication and car heating engineer, I. C.; E. G. Cromwell, lubricating supervisor, B. & O.; and H. P. Allstrand, prin. asst. superintendent motive power and machinery, C. & N. W.

Action—The report was accepted.

Car Construction

In 1932 a new program was presented and later approved by the Mechanical Division under which it was proposed to produce designs of the principal types of freight equipment cars for general interchange service, representing in each case the latest state of the designer's art with reference to weight, cost, construction, strength and general utility and of such character that any road might adopt these designs as standards and construct thereto their future cars of the types thus developed.

[The report outlined the basis on which this work is being carried on. This includes: Disregard of existing A.A.R. standards if design can be improved by so doing; co-operation with and assistance from the builders through a committee of the American Railway Car Institute; annual review of designs; provision for application of principal proprietary specialties, and license to member roads for free use of patents owned by builders covering details of construction employed.—EDITOR.]

The same year the first design of steel-sheathed wood-lined box car was completed under this program, submitted and adopted by a large majority as standard.

Since 1932 this work has been carried on in the face of an unusually difficult situation, but thus far the A. R. C. I. has generously contributed time and efforts of its chief engineers and designing organizations with the result that the work has proceeded without undue delay or interruption.

In view of these circumstances, it is regarded as a fair statement that the progress made, and the potential value of this work have been well worth the effort and when recognizing the economic value of standard car designs kept up to date, it is believed to be to the best interests of both builders and roads to continue vigorously to prosecute the work still before the joint committee, especially during a period such as the present, in order that a sound foundation for progress may be maintained.

For the past year or two, certain builders have been and now are independently engaged in developing and producing new alloy-steel designs of substantially reduced light weight for the purpose of justifying and creating, if possible, demands for replacement of older existing equipment with more efficient cars, but regardless of these undertakings, the joint work on new standard designs already completed in no sense represents wasted effort because the latter may be, and already has advantageously been used as the basis for such experimental work. Furthermore, it is a reasonable assumption that this procedure will be followed in the future because each car builder thus is in position directly to benefit from the joint experience and work of all concerned.

Whether or not full advantages are to be derived from progressive standardization of freight equipment depends largely, if not almost entirely on the attitude and position taken from this time on by the A. A. R. in the matter of building the standard designs or the still lighter weight units in high-tensile steels or other materials based thereon when cars of these types are required.

Steel-Sheathed Wood-Lined Box Car

Last year we stated that five sample cars had been built, two of which later were subjected to complete extensometer, deflectometer and impact tests in comparison with two previous designs of the same type and that complete reports with definite conclusions had been circulated.

Following impact tests which, for all three designs were conducted under full axle loads and carried well beyond collision conditions almost to the point of major failure, necessary repairs were made, after which all the A. A. R. cars, except one, were assigned to member roads for regular revenue service.

Car No. 4, which had been put through the complete test program, was turned over to the C. & O. for comprehensive road service tests under full axle load, for comparison with C. & O. companion car No. 8740. The characteristics of these cars are given in Table I.

Table I

	1	2	3	4	5	6	7
Car No.	Type construction	Light weight lb.	Lading load carried lb.	Total rail load lb.	Inside Dimensions	Cubic capcy. ft.	Type wheels
C&O 8740	Steel-sheathed wood-lined	45,900	123,100	169,000	Length 40 ft. 6 in. Width 8 ft. 9⅛ in. Height 8 ft. 7½ in.	3,060	Single-wear rolled-steel.
A.A.R. 4	Steel-sheathed wood-lined	42,000	127,000	169,000	Length 40 ft. 6 in. Wid'h 8 ft. 9⅛ in. Height 9 ft. 4 in.	3,311	Single-wear rolled-steel.

Due to difference in light weight, the lading load carried in these tests by the A. A. R. car is 3,900 lb. greater than for the companion car. As soon as practicable, complete report will be made available.

Up to March 5th, 1935, 254 days' service, mileage of 38,000 had been accumulated and during this period three different inspections under load were made. These examinations disclosed that no change in deflections had occurred in the side and center sills of either car since originally loaded.

On March 15, 1935, the loads were removed to ascertain if the deflections were of permanent or temporary character and check revealed that the bottom contours of the side and center sills on both cars were practically the same as they were before loading, i. e., no permanent sets had taken place. This is of special interest in reference to the A. A. R. car, in view of the destructive punishment it had received before being placed in this service.

Slightly greater deflection had been present in the A. A. R. car center sill at the door opening under load than was found at the same location in the C. & O. car.

After 38,000 miles of continuous operation under full load, both cars were in good condition.

This work, undertaken and carried out in its entirety by the C. & O., is most commendable and the report will contain much helpful information.

Operations in Regular Service.—Table II contains condensed comparative data on the performance of Cars, 1, 3 and 5.

Table II

A.A.R. car no.	Placed in trial service	Mileage to January 1, 1935			Mechanical defects reported
		Loaded	Empty	Total	
1	April 10, 1934	7,448	6,678	14,126	None
3	Nov. 24, 1933	7,502	7,176	14,678	Door post wood filler damaged.
5	Jan. 5, 1934	19,807	1,369	21,176	Broken reservoir release valve handle. Some damage to lining.

The reports on Car No. 2 were not sufficiently complete to permit of its inclusion, but advices received contained no references to mechanical defects.

For the most part reports from shippers and operators were decidedly favorable and in a number of cases definite preferences were expressed for the A. A. R. cars vs. other steel-sheathed designs now in general use. No claims for damage to lading were recorded.

The following criticisms on basic design characteristics were received through one road only:

(a) Metal door posts slotted for nailing strips. Use of wood door posts proposed.

(b) Thickness of inside lining. Too light for certain forms of load bracing.

(c) Steel roof. Attention was called to the possibility of sweating.

(d) Vertical end lining boards applied against inside surface of steel ends. In place of this construction it was proposed to apply the boards horizontally and to use wood nailing strips with a view to preventing accumulation of foreign matter back of the lining.

(e) Side lining slightly overlapping side plate. Contended that open space should be left between top lining board and side plate for circulation and to facilitate blowing out space back of the lining.

All of these features had previously been thoroughly discussed and carefully considered by the joint committee during the design work and, as may be seen, are equally applicable to any steel-sheathed wood-lined steel-roofed box car designed for general interchange service as well as to the A. A. R. car.

Items (c) and (e) are optional with the purchasers, but the others involve changes in general dimensions or basic design features and in view of the studies already made in reference thereto are not recommended.

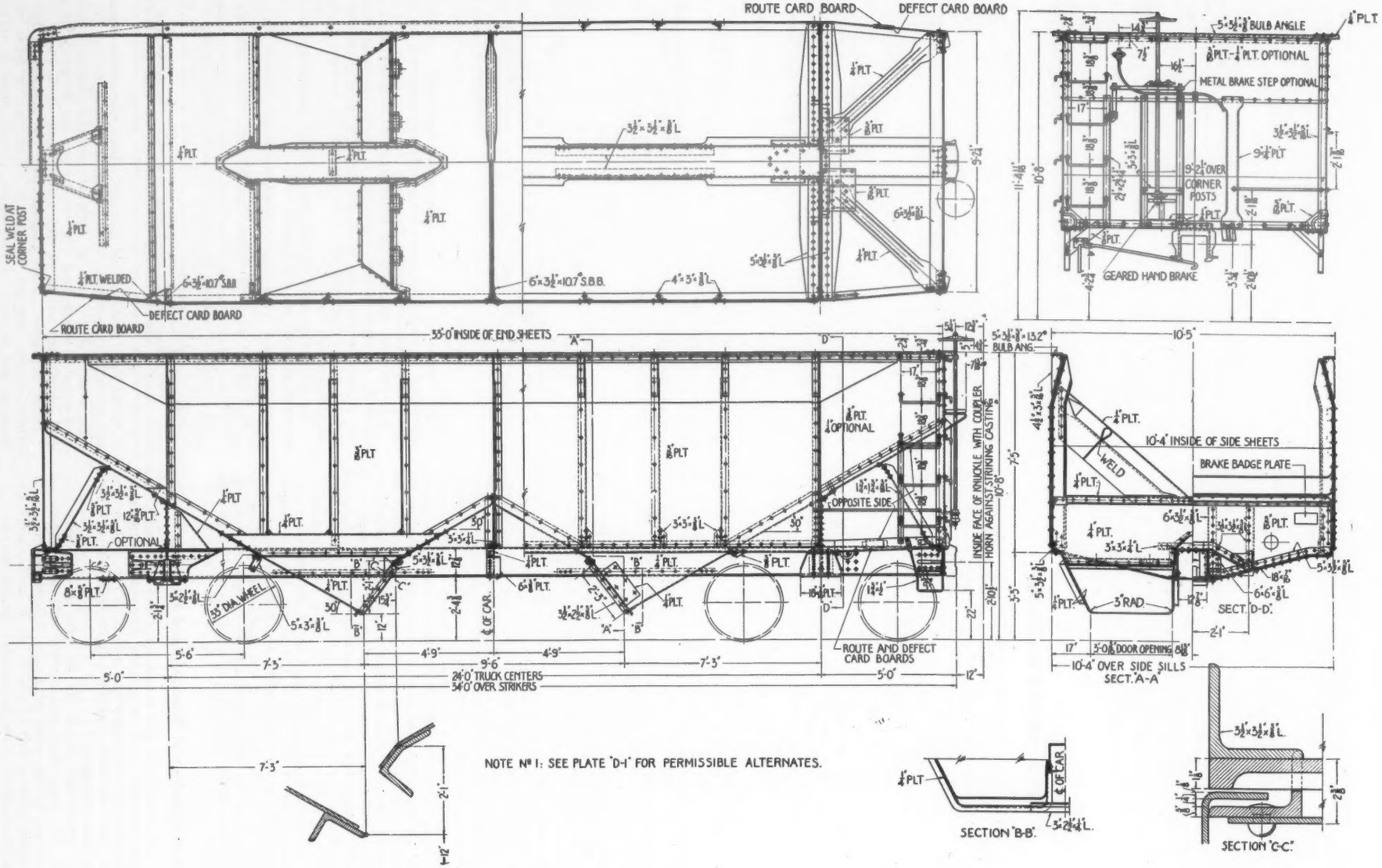


Fig. 1—Elevation, plan and sections of proposed A. A. R. standard 50-ton hopper car

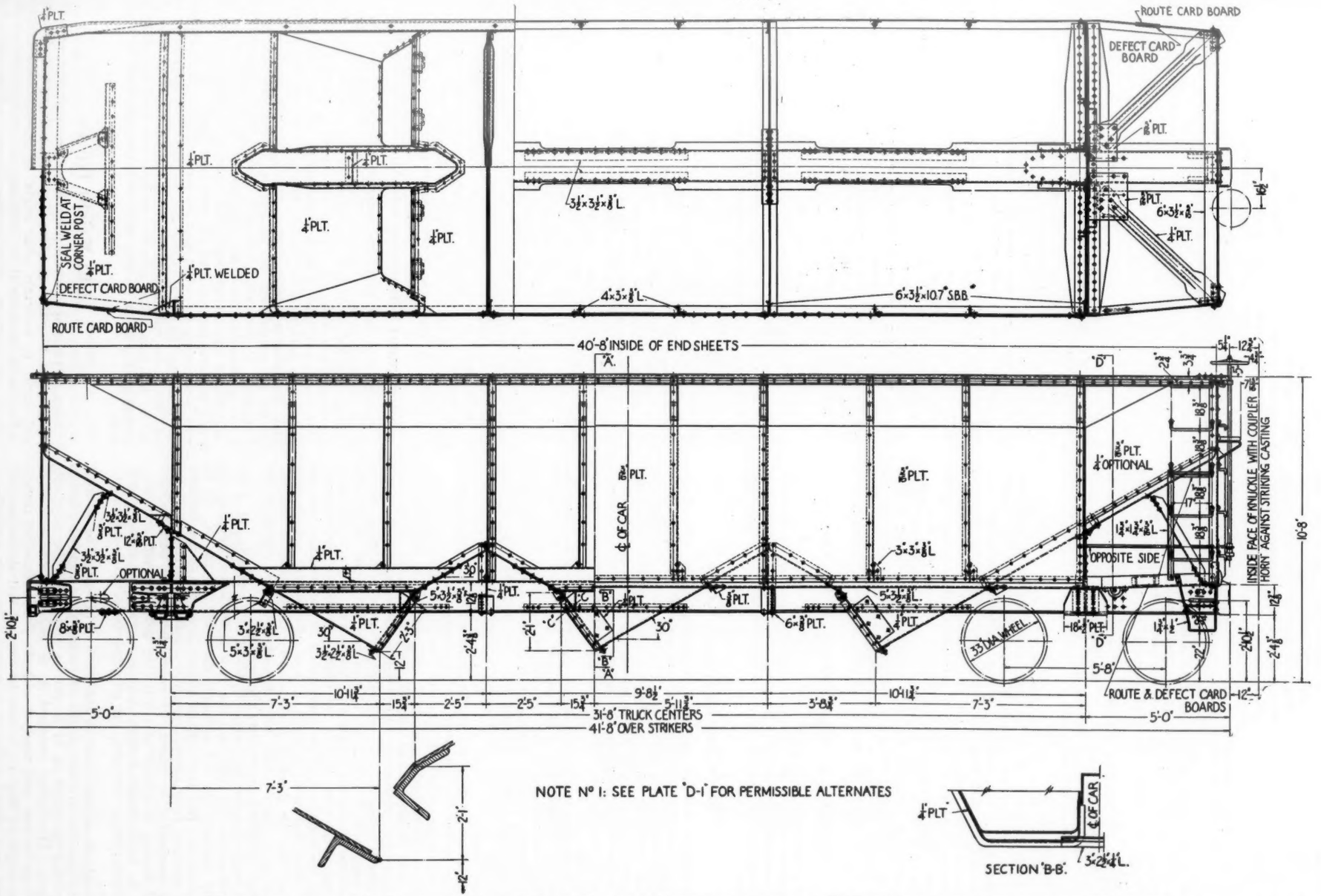


Fig. 2—Elevation, plan and sections of proposed A. A. R. standard 70-ton hopper car—End and cross sections same as 50-ton car

Standard Steel-Sheathed Wood-Lined Box Cars Thus Far Built.—During the past few years and especially since completion of the five sample cars relatively few freight cars of any type have been constructed, but the following standard box cars were produced during this period.

C. & O., Erie, N. Y. C. & St. L. A total of 1,550 fifty-ton A. A. R. standard except for former standard center sill section having cross sectional area of 28.43 sq. in. instead of the new standard Z bar section at 21.30 sq. in. This deviation from standard was made because the extensometer, deflectometer and impact test results were not known until after the orders were placed and rolls for the new section were not constructed until some time still later. The standard 25¾-in. center-plate height was used.

C. & O., 100 standard throughout, including the Z bar center sill. These were arranged for at the end of the order and after the new rolls had been made available.

Chicago Great Western—500.

Seaboard Air Line—1,000.

Total—3,150, all of 50-tons capacity.

In addition, the G. M. & N. placed order for 150 standard box cars, but specified that they should be of the steel-frame single-sheathed type. The builder involved consulted with your committee and the cars were constructed accordingly, the principal change necessary being the use of a rolled Z bar side truss arrangement in order to meet the purchaser's specification, which, in turn, required a reduction in distance over the side sills.

The L. & N. E. also acquired 250 steel-sheathed wood-lined box cars and, although it was the desire and intention of that road to build the standard car without change, this could not be done because at the time it was necessary to place the orders, rolls for the four new sections required were not available.

Steel-Frame Single-Sheathed Box Car

As a number of important roads require this type of car, your committee is under instructions to have prepared a design based on the standard steel-sheathed wood-lined car. This is now being produced as a cooperative effort of the A. R. C. I. and this committee.

Self-Clearing Hopper Cars

Descriptive analysis, specifications and complete sets of the principal drawings for 50- and 70-ton nominal capacity proposed standard hopper cars have been completed during the past year by the American Railway Car Institute Committee on Design in close cooperation with your committee under the same program and procedure followed in the production of the steel-sheathed box car presented in 1932, and are submitted herewith in Appendix A.

In accordance with the original plan agreed upon when this work was started, these drawings have been released to certain specialty manufacturers for the purpose of having prepared by them alternate designs, incorporating—(a) integral cast-steel underframe and hopper construction complete, and (b) certain parts such as bolsters, interior braces and hopper door frames in cast steel.

Comparative weights and relative costs are to be worked out as soon as studies are completed and drawings made.

In the report for 1934, statement was made that the center-sill construction would consist of continuous Z-bar members of the same design as used on the standard box car except for increase of approximately 20 per cent in net cross sectional area and that this was the only important construction item on which any important difference of opinion had developed within the committee during the progress of the work. We are glad now to report, however, that in the light of additional information made available through the impact tests of the standard box car and other data since obtained it was subsequently unanimously agreed that the standard section having cross sectional area of 21.30 sq. in. would fully meet the requirements, therefore the designs submitted incorporate this section.

Recently Constructed Hopper Cars—During 1934 the C. & O. placed orders for 6,000 and the Erie 2,500 50-ton nominal capacity hopper cars and although the work on the A. A. R. standard cars had been started at that time, the design features had not been fully agreed upon and a number of important details remained to be settled. However, these roads were desirous of following as closely as practicable under the circumstances, the A. A. R. design features and as a result the cars as built conform closely therewith, the principal deviations being as follows:

Height from rail to top of side 10 ft. 4 in. instead of 10 ft. 8 in. because the average weight of lading to be handled exceeds somewhat the figure of 52 lb. per cu. ft. used in the A. A. R. designs. The former standard A. A. R. center-sill section of 30.19 sq. in. was used, together with the former standard center-plate height of 26¾ in., in view of the fact that at the time the orders were placed, sufficient information was not available to justify, in the opinion of the purchaser, the use of the new Z-bar section of somewhat reduced cross-sectional area. Pressed steel side stakes were used in place of the rolled sections now shown on the A. A. R. drawings. The sample car of a lot of ultra light-weight hopper cars produced by a builder, was completed during October, 1934. This development is described further in Appendix A.

Refrigerator Car

A review of the association's activities concerning refrigerator-car design is essential as a basis for the present report.

In April, 1926, the Car Construction Committee began the design for a ventilated refrigerator car, based upon the elements of the steel box-car design of that period. While the committee made progress with that design, it was not fully completed in all details nor submitted for adoption. However, this car was a distinct improvement over the wood-framed car in general use, embodying steel framing in the superstructure which prevents weaving, wracking and damage to insulation. Subsequently two roads, the Santa Fe and the Union Pacific built refrigerator cars to that design and these cars have well demonstrated the advantages of a rigidly built superstructure in preserving alinement and reducing maintenance costs.

There were some further activities by the committee during 1927, 1928 and 1929, and in November, 1929, the subject was removed from the docket.

In the latter part of 1932 the importance of the refrigerator car was again brought to the attention of the committee, but due to the large volume of regular work then being handled, which included development of standard hopper-car designs, it was found impracticable to undertake preliminary development of the refrigerator car until early last year, at which time a sub-committee was appointed to handle the design.

A questionnaire was then circulated to develop preliminary information on the basic features, arrangement and characteristics which would best meet the requirements of traffic handled in refrigerator cars. The replies, which were comprehensive in their scope, were tabulated and analyzed, the principal fundamentals were formulated and subsequently approved by the Car Construction Committee. Briefly, these fundamentals include capacity, inside dimensions, structural composition, insulation requirements, ice capacity, etc. The inside dimensions agree with those of a large majority of existing cars, and permit of the use of the present A. A. R. box-car underframe as a basic standard. Meetings were then held with a committee of refrigerator-car operators to review the fundamentals. As a result of this co-operation, the conclusions of these two committees are now in close coincidence on all essential points.

The sub-committee also met jointly with the Federal Co-ordinator's Mechanical Advisory Committee and exchanged views and data in the hands of these respective committees. They also reviewed government reports and other data bearing upon the general subject. With the ground thus prepared, the work on the car is now in shape where active design may be undertaken as a cooperative effort among the Car Construction Committee, the car operators, the car builders (A. R. C. I.) and such manufacturers as may be involved. From this point onward, the standard car development program submitted and accepted by the Mechanical Division in 1932 is to be followed with a view to completing the work as promptly as possible.

Equipment Clearances and Maximum Outline

As reported last year, the diagram adopted by the A. R. E. A. in 1934 as the "Limiting Equipment Diagram for Interchange Service" contained no reference to the fact that cars to these dimensions are subject to operating restrictions. A conference was held with representatives of the Engineering Division to straighten the matter out and agreement was reached that this diagram, with certain detail changes decided upon, should be revised and set up as the "Maximum Outline for Equipment in Restricted Service." It was further agreed that from information previously obtained a limiting diagram for unrestricted interchange, somewhat larger than present Plate B, could be developed and that this would be done.

It is necessary to report that the large diagram for restricted operation has not been revised and the improved diagram based on Plate B for unrestricted service has not as yet been developed. Action has been taken, however, to have this work completed as promptly as possible so that these two diagrams may be available.

Light-Weight Trucks

Some 10 years ago certain truck-frame manufacturers and railroads initiated jointly a program of side-frame tests, both dynamic and static, to ascertain what might be accomplished through redistribution of material in increasing the strength and service life of such castings. At that time dynamic testing was not a

new art as previously it had been used by at least one manufacturer for checking designs.

This was followed by a series of dynamic tests conducted under the jurisdiction of the then A. R. A. by a sub-committee, and in 1929 these efforts culminated in the adoption of the present specifications under which frames are produced having much greater ability to withstand service stresses than those previously acceptable, but at no increase in weight.

These frames were made of medium-carbon steel and in 1933 the A. A. R. adopted the present specification for Grade B carbon steel which, although of the same general classification, is of superior quality and has higher physical properties. Consequently still further improvement has been obtained in truck side frames.

and that when high-tensile materials adjudged satisfactory for this purpose had been selected, it would be necessary thoroughly to test, both statically and dynamically, actual side frame specimens as an indispensable part of the development work before such frames could be regarded as satisfactory for interchange service. This latter provision was considered as of special importance by reason of the fact that truck side frames constantly are subjected to uncushioned dynamic loads and shocks while in motion. Furthermore, previous experience had indicated that it is characteristic of all high-tensile alloy steels, both forged and cast, to appear to greatest advantage under static test.

Design and laboratory studies immediately were undertaken but due to adverse business conditions the work progressed rather slowly, although previously side frames and bolsters of light sec-

JOURNAL SIZE	CAPACITY OF CAR	A	B	C	D	E	F	G	H	J	K
5"x9"	40 TON	5'-6"	10½"	13"	12 13/16"	8"	6'-4"	5 3/4"	5½"	7 9/16"	3/8"
5½"x10"	50 TON	5'-6"	10½"	13"	12 13/16"	8½"	6'-5"	6¼"	6"	7½"	7/16"
6"x11"	70 TON	5'-8"	11½"	17"	16 13/16"	9"	6'-6"	6¾"	6½"	7 13/16"	½"

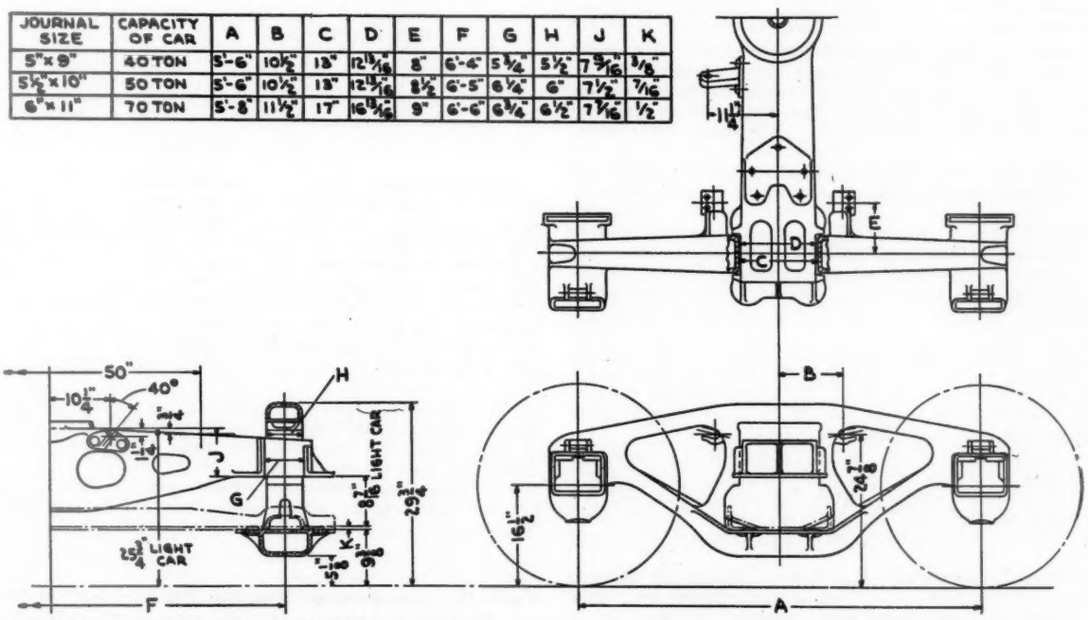


Fig. 3—Spring plank type truck of light design with side frames and bolsters of high-tensile steel

JOURNAL SIZE	CAPACITY OF CAR	A	B	C	D	E	F	G	H
5"x9"	40 TON	5'-6"	10½"	14"	13 13/16"	8"	6'-4"	5 3/8"	5½"
5½"x10"	50 TON	5'-6"	10½"	14 13/16"	14 13/16"	8½"	6'-5"	6 1/8"	6"
6"x11"	70 TON	5'-8"	11½"	18"	17 13/16"	9"	6'-6"	6 5/8"	6½"

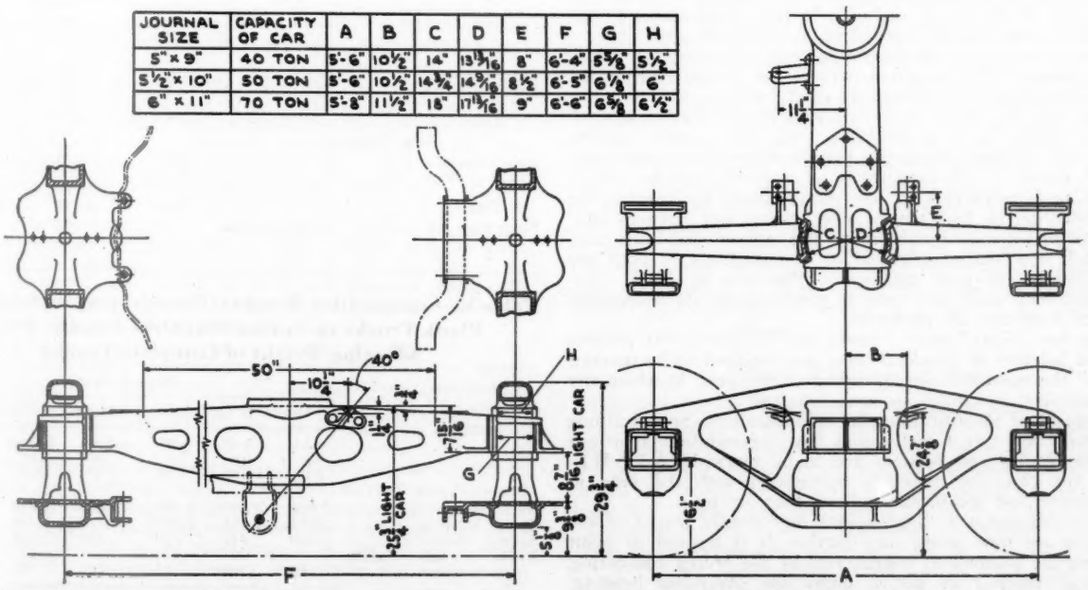


Fig. 4—Spring-plankless type truck of light design with side frames and bolsters of high-tensile steel

During 1930 the problem of further weight reduction in side frames and bolsters was again taken up with the manufacturers with a view to obtaining, if found practicable, the benefits accruing from advancements in the metallurgical art as represented by high-tensile steels.

It was understood and agreed that this work should be regarded as a continuation of previous efforts with medium-carbon steels

tions had been made by the manufacturers under the Four-Wheel Railway Truck Agreement of steels of several compositions and heat treatments and tested to an extent sufficient to establish a definite basis for further work. Early in 1934 the manufacturers, by their Engineers' Committee intensified this work as an active joint program of design, experiment and test, to develop a practicable combination of light-weight side-frame

and bolster designs and high-tensile steel suitable for production and service requirements.

As a basis for this development it was tentatively established that these parts should meet the same permanent set and other strength requirements as prescribed in the A. A. R. 1929 specifications when made of Grade B carbon steel but that increased deflection would be unavoidable on account of lighter sections and reduced moments of inertia and the fact that the modulus of elasticity of high-tensile steel is practically the same as that for Grade B steel.

To meet these test requirements with the minimum sections practicable for production of side frames and bolsters and to have proper ductility, the following were tentatively established for the minimum physical properties of the steel to be used:

Tensile strength, lb. per sq. in.	90,000
Yield point, lb. per sq. in.	60,000
Elongation in 2 in.	22 percent
Reduction of area	45 percent

A manganese-vanadium steel, double normalized (not liquid quenched), was used which met these physical requirements. This material showed a ductile behavior under static test similar to that of Grade B carbon steel. The approximate chemical composition is as follows: Carbon, .30; manganese, 1.65; vanadium, .10.

This material was used, not as a limitation against other suitable steels but because of previously developed knowledge of its properties.

Special light designs of 50- and 70-ton side frames and bolsters were then prepared, proportioned by careful calculation and from knowledge gained during previous experiments. The A. A. R. specification limits for design fibre stresses were exceeded in the calculations because of the use of high-tensile steel and reduction in sections.

Static Tests.—Patterns were then constructed, sample castings made and checked, followed by the production of castings which were statically tested under A. A. R. 1929 requirements. From the data secured, further improvements in design were made and this procedure was successively repeated.

Dynamic Tests.—Present A. A. R. specifications purposely were formulated so as to provide for acceptance under static tests only when using Grade B steel, but the background for these test requirements with this material had previously been established through a prolonged series of dynamic tests and research.

In the present developments of lightened high-tensile designs, it is necessary in the interest of both manufacturers and users for such frames of each design and capacity produced to be subjected to complete dynamic tests, preferably on both manufacturers' machines now available, in order to develop the required background on which static test and design requirements ultimately may be based for inclusion in the specifications covering acceptance test and this procedure is being followed.

However, consistent with present testing procedure for Grade B frames, dynamic test requirements are not to be incorporated in the specifications for high-tensile steel frames.

It is not the purpose of this report to submit further discussion of the details but it is desired to state that tentative agreement has been reached among the manufacturers' engineers committee and the A. A. R. committees on Specifications for Materials and Car Construction on test requirements for current use in the production of high-tensile side frames and bolsters now being placed in service. Furthermore, it is agreed that such castings of each new design, material or combinations of both are to be subject to the joint approval of the two A. A. R. committees mentioned until such time as specifications for acceptance under static tests may be produced.

Marking for High-Tensile Frames and Bolsters.—At present frames and bolsters of Grade B steel are required to be marked "AAR-29," the numerals corresponding to the year in which the present static-test specifications were adopted.

For purposes of identification, the committees on Specifications for Materials and Car Construction have agreed that approved high-tensile frames and bolsters are to be marked "AAR-HT-35." In this case the numerals correspond with the year in which tentative test specifications have been set up.

Welding.—Inasmuch as light-weight high-tensile trucks of the new designs are now going into service, it is desired to point out, pending the issuance of instructions by the proper committee, that castings marked as shown under the preceding heading, should not be subjected to welding of any kind.

The material thus far used can be welded under properly instructed and experienced supervision, but a preheating temperature of approximately 500 deg. F. must be employed, followed by heat treatment proper for this particular steel and inasmuch as high-tensile steels of other compositions no doubt will be used and in view of the fact that heat treatment and temperatures to suit are necessary, all welding thereon should be prohibited pending further developments and experience.

Comparisons of Truck Weights.—The following tabulations, supplemented by brief comment, are presented to illustrate the progress which has been made in the actual production of high-tensile frames satisfactory to the committees on Specifications for Materials and Car Construction for interchange service.

Table III—Comparative Weights (Pounds) per Car Set of Side Frames and Bolsters for Spring-Plank Equipped Trucks—High Tensile vs. Grade B. Steel

	Journal size		
	5 in. by 9 in.	5½ in. by 10 in.	6 in. by 11 in.
GRADE B			
Side frames	2,090	2,390	2,970
Truck bolsters	1,455	1,595	2,085
Total	3,545	3,985	5,055
HIGH-TENSILE			
Side frames	1,800	2,000	2,400
Truck bolsters	1,170	1,260	1,570
Total	2,970	3,260	3,970
Saving per car, in favor of high-tensile	575	725	1,085

Spring-Plankless Truck.—A spring-plankless self-alining truck has been under development by the truck manufacturers' engineers committee. The design incorporates specially shaped engaging surfaces between the bolster and side frame columns so that alinement is maintained with large uniform bearing contact, in the absence of the spring plank. Provision is also made on the side frames for attachment of a brake-beam safety device. Some trucks of this design are now in service. This type of truck can be made either of Grade B or high-tensile steel and castings for both designs have passed satisfactory static and dynamic tests.

The principal object of producing the spring-plankless truck was to achieve further weight saving without sacrifice of strength or service stability but, with this truck spring-plank maintenance difficulties also are eliminated.

For direct comparisons of weight savings, Table V has been prepared showing the spring-plank type vs. the spring-plankless type trucks in both Grade B and high-tensile steel.

Table IV—Comparative Weights (Pounds) per Car Set of Side Frames and Bolsters for the Spring-Plankless Type Trucks—High Tensile vs. Grade B. Steel

	Journal size		
	5 in. by 9 in.	5½ in. by 10 in.	6 in. by 11 in.
GRADE B			
Side frames	2,162	2,462	3,050
Truck bolsters	1,469	1,633	2,113
Total	3,631	4,095	5,163
HIGH-TENSILE			
Side frames	1,852	2,052	2,460
Truck bolsters	1,180	1,290	1,592
Total	3,032	3,342	4,052
Saving per car, in favor of high-tensile	599	753	1,111

Table V—Comparative Weights (Pounds) per Car Set Spring-Plank Trucks vs. Spring-Plankless Trucks—Items Affecting Weight of Complete Trucks

	Journal Size					
	Grade B Castings			High-Tensile Castings		
	5 in. by 9 in.	5½ in. by 10 in.	6 in. by 11 in.	5 in. by 9 in.	5½ in. by 10 in.	6 in. by 11 in.
SPRING-PLANK TRUCKS						
Side frames	2,090	2,390	2,970	1,800	2,000	2,400
Truck bolsters	1,455	1,595	2,085	1,170	1,260	1,570
Spring planks	380	448	570	380	448	570
Brake beam safety attachments	40	40	40	40	40	40
Total	3,965	4,473	5,665	3,390	3,748	4,580
SPRING-PLANKLESS TRUCKS						
Side frames	2,162	2,462	3,050	1,852	2,052	2,460
Truck bolsters	1,469	1,633	2,113	1,180	1,290	1,592
Brake beam safety attachments	77	77	79	77	77	79
Total	3,708	4,172	5,242	3,109	3,419	4,131
Saving per car, in favor of Spring-Plankless	257	301	423	281	329	449

In order to set forth in convenient form, the present maximum weight savings per car which may be obtained through the use of the high-tensile spring-plankless truck in place of the present spring-plank equipped design in Grade B steel, Table VI is presented.

Table VI—Comparative Weights (Pounds) per Car Set, High-Tensile Spring-Plankless Trucks vs. Grade B. Spring-Plank Trucks—Items Affecting Complete Truck Weights

	Journal size		
	5 in. by 9 in.	5½ in. by 10 in.	6 in. by 11 in.
SPRING-PLANK TRUCKS GRADE B CASTINGS			
Side frames	2,090	2,390	2,970
Truck bolsters	1,455	1,595	2,085
Spring Planks	380	448	570
Brake Beam safety attachments	40	40	40
Total	3,965	4,473	5,665
SPRING-PLANKLESS TRUCKS HIGH-TENSILE CASTINGS			
Side frames	1,852	2,052	2,460
Truck bolsters	1,180	1,290	1,592
Brake beam safety attachments	77	77	79
Total	3,109	3,419	4,131
Saving per car, in favor of Spring-Plankless, High-Tensile	856	1,054	1,534

Coileaf Spring-Plankless Truck

The National Malleable & Steel Castings Company has produced another design of spring-plankless truck designated as the Type "B" Coileaf with which a combination consisting of a double-helical spring assembly and a semi-elliptic spring to support the bolster is positioned within each side frame. The principal objectives sought in this design are reduced weight and improved riding characteristics, and it is understood that in addition to the regular Type "B," a light-weight design also has been developed. With this truck, it follows that the difficulties and expense of spring-plank maintenance are eliminated.

Detail information regarding comparative weights, together with corresponding static and dynamic test results for the two designs are not yet available, but your committee expects that in due course full report may be formulated.

Bottom Rod and Brake Beam Safety Supports

There are in service many types of brake-beam safety supports secured either by loose-fitting bolts or by rivets not properly filling the holes and these have caused considerable trouble by becoming disengaged due to improper application and poor maintenance.

The experience of a number of roads in applying devices shown on pages E-3-4-4A and 4B of Section "E" of the Manual by riveting and welding the supports to the spring plank in accordance with notations given on these sheets, developed that the devices have been successfully held where the single-angle auxiliary support is applied. With a single angle attached near the center it is not necessary to detach same in order to remove or apply a brake beam.

The importance of good workmanship should not be overlooked. It is necessary that rivets be of the size called for and be properly driven to fill the holes and that the portions to be welded be properly cleaned and welded in accordance with the notations given on the drawings.

There are in service proprietary devices different in design from the non-patented devices given in the Manual, also others which have been developed since 1932 and have been submitted to and approved by the Car Construction Committee, any one of which will provide efficient safeguards in case of failures of brake hangers or connecting parts and still permit accessibility in application and renewal of brake beams without cutting attachment rivets which should not be disturbed.

While the difficulties of brake beams dropping down due to failures of hangers may be minimized by improved materials, better designing and proper maintenance of brake-beam hangers and pins, it is considered necessary to provide and maintain on all cars in interchange service, efficient and economical safety supports for the bottom rod and brake beams.

Truck Springs

Non-Harmonic Spring Devices.—Under date of April 19, 1934, a progress report, showing results of the laboratory and road tests, conducted for the purpose of determining the riding characteristics of existing truck springs and to ascertain to what extent these characteristics could be improved by the use of available devices, variously designated as friction springs, snubbers and stabilizers, or by the use of trucks of special design. Following completion of the laboratory and road tests, the various devices tested were placed in service—two car sets of each—under General American Transportation Company refrigerator cars to obtain comparative information as to endurance qualities.

The endurance test is still in progress. The plan being followed is to inspect each car every six months, at which time springs or special trucks are removed and subjected to a calibration test in the A. A. R. laboratory at Purdue University. After this they are reapplied for another service period of six months.

When endurance test and final laboratory calibrations have been completed, a final report will be submitted. At that time the question of the desirability and practicability of formulating recommended specifications for non-harmonic springs and special truck designs for the same purpose, as included in original plan, again will be given due consideration. However, it is the present view that for a newly introduced development of this importance a much broader and more prolonged background of experience in both design and operation than made available as the result of these investigations probably will be required for the attainment of this objective.

The final report will also include recommendations with respect to additional tests or other investigations that in the opinion of sub-committee should be made. This progress report, together with the fact that these tests are being conducted, should not be construed as a deterrent by those contemplating application of such devices.

Helical Spring Groups

In the 1932 report, designs of helical springs for 40-, 50- and 70-ton nominal capacity trucks were included and were later submitted to letter ballot and adopted as recommended practice. These designs were prepared principally to meet maximum loading and service conditions, to eliminate continual expense of replacing broken springs, and were to be made of plain carbon steel to the then existing A. R. A. material specifications.

In 1933 revised specification for heat-treated carbon-steel helical springs was adopted as recommended practice and it has therefore been considered necessary to prepare new designs to suit the requirements of the revised specification. The subcommittee is now developing designs of helical springs to be designated as C, D, H and P for the 40-, 50-, 70- and 100-ton nominal capacity trucks. These designs will be prepared to interchange in the space now occupied by the present A. A. R. spring groups.

Truck Spring Planks

Early in 1934 attention of the committee was called to the trouble some roads were having with spring plank breakages, and a subcommittee was appointed to make a study of this trouble. The Truck Manufacturers' Engineers Committee was invited to assist in this study. Several designs of spring planks to eliminate this breakage are now being tried by various roads, and new designs of trucks without spring planks are being built.

Some of the trouble experienced with breakage of spring planks is caused by lack of rigid inspection at time of assembling trucks, and due to close fit of spring planks on truck side-frame bosses. It is recommended that A. A. R. Plates 23, 24 and 25 for 40-, 50- and 70-ton cars be modified to show $2\frac{1}{32}$ in. holes for side-frame bosses changed to $2\frac{1}{4}$ in. diameter to permit additional clearance and more flexibility in the truck. This committee also suggests that roads experiencing trouble with spring-plank failures would find relief if existing spring planks were changed by reaming the side frame boss holes to provide a total clearance of $\frac{1}{4}$ in.

Rail Motor-Car Axles

The last report contained a statement that Rolling Stock Committee No. 1 of the American Transit Association had made final report with recommendations as shown in the 1933 supplement to the Engineering Manual, Section E-3-33 covering Design of Axles for Electric Railway Motors. Further, that these recommendations had been approved by that association.

Subsequently the A. A. R. committee on Specifications for Materials was requested to check the A. T. A. specifications against the A. A. R. specifications covering materials for passenger service axles and to advise as to what specifications should be followed for rail motor-car axles.

During the past year the committee on Specfications for Materials has revised a large number of A. A. R. specifications, including those for the different grades of axles and consequently that committee is now in better position to conclude this assignment.

As soon as advice requested is received, it is proposed to issue a special letter ballot on designs and materials for the different types and capacities of axles required for rail motor car

service. If approved, these specifications will be incorporated in the Manual.

Standard Center Plate

As stated in the 1934 report, a center plate having nominal diameter of 12 in. is the present standard for the 2-C, 2-D and 2-E trucks regardless of differences in load-carrying capacities or corresponding bearing pressures. The first standard adopted in 1903 for 80,000- and 100,000-lb. capacity cars was of 12 in. nominal diameter and since that time only minor changes in detail dimensions have been made.

As a result of a study now completed and in view of replies received to an inquiry, a center plate having nominal diameter increased from 12 in. to 14 in. has been included in the design for the new proposed A. A. R. standard 70-ton hopper car, submitted in Appendix A.

Briefly stated, the reasons for this change are as follows: (1) Reduced bearing pressures; (2) less cutting of center plate surfaces and reduced wear on wheel flanges and movable truck parts; (3) reduced resistance to swivelling.

Table VII for 70-ton cars with nominal load on each center plate of 96,000 lb. and for 50-ton cars at a center plate load of 76,700 lb. is here presented in order to illustrate the situation with respect to 12 in. and 14 in. diameter center plates:

Table VII

1	2 Nominal center plate load 96,000 lb.		3 Nominal center plate load 76,700 lb.	
Nomiral diameter	Net area, sq. in.	Bearing pressure, lb. per sq. in.	Net area, sq. in.	Bearing pressure, lb. per sq. in.
12 in.	81.67	1172	81.67	940
14 in.	119.35	804	119.35	642

NOTE—Total truck weight per car set used in Column (2) is 18,000 lb. and for Column (3), 15,600 lb.

It is recommended that the 14 in. diameter center plate be made standard for all future cars of 140,000 lb. nominal capacity and that this item be submitted to letter ballot.

Hand Brakes

Due to increasing use on freight cars of numerous designs of so-called "power" or geared hand brakes in which various features of design are incorporated, which in turn directly affect operating characteristics, application and maintenance, the Car Construction Committee decided about two years ago that it would be necessary to standardize on basic features before the situation reached the point where the number of different devices in service would make such standardization more difficult and expensive, if not impracticable. This conclusion was reached with full knowledge that satisfactory conventional non-proprietary types of hand brakes were available and in general use.

Preliminary specifications were prepared in 1933 and submitted for consideration of the full committee during a regular meeting held in April of that year, at which time a sub-committee was appointed to investigate the various designs. This work resulted in the formulation of a tentative specification for basic requirements of design and operation with a view to bringing about uniform practices and interchangeability insofar as practicable and consistent with existing I. C. C. and A. A. R. regulations and standard practices.

During recent months this study, which includes geared hand brakes of the vertical wheel, horizontal wheel and lever types, has been proceeded with in co-operation with the committees on Brakes and Brake Equipment and Safety Appliances. The tentative specifications as first set up cover all features jointly agreed upon and concurred with in principle by the Director of the Bureau of Safety of the I. C. C., whom your representatives have consulted.

It is desired to emphasize the fact that from the outset the formulation of the proposed fundamentals for geared hand brakes has been proceeded with for the purpose of making these requirements applicable only to future hand-brake applications and with the understanding that such specifications or rules pertaining thereto, are not to apply to existing installations. Furthermore, there is no desire, disposition or intention on the part of the joint subcommittee or the main committees involved, in any way to restrict developments.

Condensation in Box Cars

A progress report was presented last year based upon extensive winter weather field work in loading hot flour and cereals in four Pennsylvania steel-sheathed wood-lined box cars and inspecting condition of loading at destination. With the co-operation of the Freight Claims Division, the Freight Containers Bureau and the Director of Research of the Mechanical Division, the investigation was continued last winter under a jointly formulated program and with the benefit of the previous year's experience.

Through cooperation and assistance of the Chicago Great Western, four steel-sheathed, fully wood-lined box cars were assigned to the test and specially fitted up for the purpose of the investigation. Each car was equipped with four observation windows, internal lighting, observation trap doors in side and end lining, and in the roof linings where used. Each car was provided with 12 electrical resistance distant-reading thermometers with extensions leading into an office car also provided by the C. G. W.

It had been previously determined that all phenomena connected with interior condensation occur within 48 hrs. after loads are completed and must be observed within that period. In-transit tests were therefore abandoned in favor of standing tests, resulting not only in continuous and accurate observations throughout the critical period, but also in a decided acceleration of the program. For this purpose the cars after loading were set on a spur track, kept under observation throughout the critical period, opened and the contents checked as unloaded at the warehouse platform.

Realizing that condensation is not confined entirely to roof sweating, the four test cars were prepared with the following interior treatment:

Car No. 1—Wood-lined—plain painted steel ceiling as from builder.
Car No. 2—Same as car No. 1 except it has also a wood ceiling.
Car No. 3—Same as car No. 1 except it has all inside metal surfaces, including side and end sheets back of wood lining, sprayed with sawdust applied on an asphalt emulsion.
Car No. 4—Same as car No. 3 except it has also a wood ceiling.

The investigation starting December 5, 1934, ending February 5, 1935, was favored by a variety of weather and temperature conditions. It is believed that this investigation is as thorough and comprehensive and the conclusions as accurate as are possible or necessary for a final disposition of the problem. A brief statement of the facts developed during the progress of the tests is as follows:

1. Condensation appears during construction of the load in all cars during all "Hot" lading tests, showing on windows and extreme top of doors.

2. No visible change from the above condition is found in any of the cars for a period of approximately one and a half hours after doors are closed on the completed load.

3. Following the above period, condensation becomes visible to an increased extent showing mostly on windows and unprotected metal surfaces.

4. Condensation appears in the form of frost when outside temperatures are 20 deg. F. or lower, and in the form of moisture when such temperatures are higher than 20 deg.

5. During the progress of the tests, frozen condensation on unprotected steel ceilings melted when outside temperatures went above freezing or above 20 deg. F. with a bright sun.

6. Condensation above wood ceiling is in extent and degree somewhat less than on unprotected metal roofs.

7. Condensation was found on metal surfaces back of all the wood linings, to a greater extent above the load level than below.

8. Temperatures of the flour and cereals at the packing floor and at the car were practically the same.

9. Temperatures of the flour and cereals in the load reduced during the period of the tests, depending upon outside temperatures. Cases and bags in the top layer and adjacent to the sides of the cars were brought to a lower temperature than were those in the middle of the load.

10. Flour or cereals pre-cooled to 50 deg. F. will not produce condensation to a dangerout extent in all-steel box cars. This fact is an outstanding feature and *pre-cooling the "hot" lading is the only known practical means of eliminating condensation in all-steel cars at hand.*

Conclusions.—The sum of the conclusions gives but one answer—supplementary structures inside of steel box cars, such as wood ceilings, cork or saw-dust layers, etc., on steel surfaces are wholly inadequate to cope with the moisture developed with "hot lading" in outdoor temperatures below freezing. To exceed such supplementary construction is economically and practically prohibitive, encroaching on the realm of refrigerator-car construction and insulation. It is estimated that in temperatures below 20 deg. F., with box cars carrying "hot lading," as much as 60 gal. of water per car are developed from condensation under unfavorable atmospheric conditions. As a result of these conclusions which have been determined after two years of fair and impartial investigation under a wide range of weather and temperature conditions and bearing in mind the comparatively small percentage of claims for damage that can be definitely traced to sweating and not to leakage at roofs, doors, etc., the committee believes that there is no form of interior treatment of the steel

box car within economic practicability that will wholly prevent condensation from affecting "hot" loads unless pre-cooled to 50 deg. F. or less. While these tests have shown some slight degree of amelioration of the conditions which it is sought to correct, it does not extend to a degree sufficient, in the opinion of the committee, to warrant the expenditure necessary thus to equip the cars coupled with the cost of hauling the extra dead weight.

Different methods of interior treatment have been tried in an effort to prevent or retard condensation. A typical method, for example, is to line under the roof with wood lining. Such treatment results in 1,000 lb. to 1,200 lb. additional dead weight, and a cost of $55.00 to $60.00 per car.

Bearing upon the question of claims for damage actually traceable to condensation and not other causes, the committee cites as a fair average example the records of one of the largest roads for the years 1931 to 1934 inclusive. They found 1,834 flour claims paid during this period, of which 181 were based on damage because of the shipment being wet. This, however, does not indicate that the moisture was caused by condensation in the car. It might have been caused by leaking roof, moisture entering through doorway, or other parts of the car. These 181 claims amounted to $3,739.00, which covered 18 flour shipping points and a number of smaller stations where flour was loaded. So far as that road could determine, there were only four cases in this entire number where any reference was made to shipments sweating or damage caused by sweating of car interior, so apparently claims submitted for that cause are quite inconsequential and would not seem to justify the development of a special type of car.

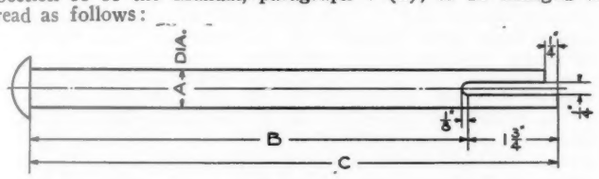
In 1932 a typical large road loaded 1,356,081 box cars (including l.c.l. freight). The total of cars loaded with flour was 25,592 or 1.89 per cent of the whole. This provides a fair idea of the expense which might be incurred as compared with, not only the claims involved, but the small percentage of such claims as can be established as due to damage from actual condensation. The committee concludes that a special type of car is not established or justified.

[The progress report submitted by the subcommittee was unusually full and complete. It included photographs, charts and tables of the data obtained, together with a full description of the tests conducted.—EDITOR.]

Journal Boxes

At a recent meeting it was agreed that the following changes should be made:

Journal-Box Lids.—Specification shown on page A-337-1933, Section A of the Manual, paragraph 4 (a), to be changed to read as follows:



FORGED STEEL PIN

C	B	A	JOURNAL
9"	7 1/4"	5/8"	4 1/4" x 8"
10 3/8"	8 5/8"	3/4"	5"x9", 5 1/2"x10"
11 5/8"	9 7/8"	3/4"	6"x11"

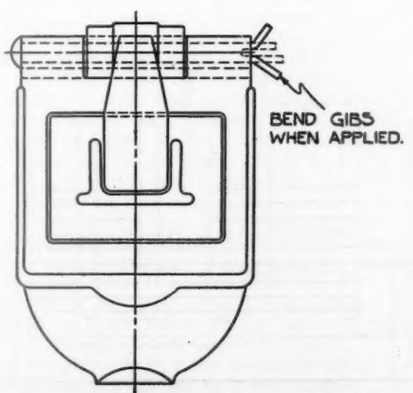


Fig. 5—Proposed split pin for journal box lids

4. Construction. (a) Lid to be attached to the journal box by means of a pin, bolt, rivet *or split rivet* 1/32 in. less in diameter than the size of the hinge lug hole in the box. The use of separable cotter pins or split keys is prohibited. *The use of a split rivet, as per sketch attached, is preferable for lids having open ends.*

[Italics indicate new or principal changes—EDITOR.]

Journal-Bearing Wedges.—Page D-25-1932 be altered to include a radius not less than 3/16 in. at the top corner of the wedge, to provide proper clearance between wedge and box.

Design of Journal-Box Bottom.—There seems to be an opinion that boxes with a circular bottom are more conductive to the rolling of packing than those with a square bottom. This matter was discussed and the committee was of the opinion that we could not justify any changes at this time.

Malleable Castings

About two years ago your committee was requested again to review the question of using malleable iron castings in freight-car construction and advice has been received from the Malleable Iron Research Institute that the following physical properties may now be demanded:

Yield point at least 35,000 lb. per sq. in.; elongation 18 per cent in 2 in.; ultimate strength 55,000 lb. per sq. in.

It is stated by the Institute that malleable iron may be produced in sections of 5/16 in. as compared with 3/8 in. for electric steel and 7/16 in. for open hearth steel; also that malleable-iron machines more easily than steel castings, forgings or gray iron and that it can be produced in intricate designs smooth and true to patterns and suitable for application to rolled or finished shapes without grinding or finishing.

We have, therefore, reviewed this subject and for the guidance of those interested, the following list of parts is submitted:

FREIGHT CAR ITEMS FOR WHICH MALLEABLE IRON IS CONSIDERED A SATISFACTORY SUBSTITUTE FOR CAST STEEL

Brake-badge plate.
Brake-beam strut.
Brake head.
Body side-bearing brace.
Coupler carrier.
Corner cap, end and side plate connection.
Draft-gear cheek plates.
Draft-gear carrier.
Front follower block used with horizontal yoke attachments.
Hand-brake wheel, pawl, pawl plate and ratchet wheel.
Journal-box lid.
Push-pole pocket.
Truck side-bearing housing, antifriction type.
Uncoupling lever brackets.

NOTE—This list is not intended to include all proprietary details which may be offered in malleable iron.

Definitions and Designating Letters for Cars

During the past year recommendations have been received relative to change in definitions for the "RS" Bunker Refrigerator car and "HF" Hopper car and requests have been made for new designating symbols and definitions to cover a Beef Rail Refrigerator car; Depressed Center Flat car and Special Type Insulated Enclosed car designed primarily for bulk sugar transportation.

The following are the proposed changes and new definitions.

[Italics indicate new or principal changes.—EDITOR.]

CLASS "F"—FLAT CAR TYPE

"FD"—Depressed Center Flat. A flat car of special construction having the portion of floor extending between trucks depressed to provide necessary head room for certain classes of lading.

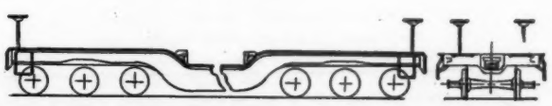


Fig. 6—Proposed "FD" depressed-center flat car

CLASS "H"—HOPPER CAR TYPE

"HF"—An Open Top Self-Clearing car, having fixed sides and ends and bottom consisting of two *or more* divided hoppers with doors hinged crosswise dumping between rails; also two divided hoppers extending from end of car to bolster, with doors hinged lengthwise of car and dumping outside of rails.

CLASS "L"—SPECIAL CAR TYPE

"LS"—A heavily insulated, self clearing, permanently enclosed car, having fixed roof, sides and ends, and provided with openings for loading through roof and outlets at bottom for unloading. Top openings fitted with weather-tight covers and bottom outlets with leak-proof valves. Designed primarily for bulk sugar transportation.

CLASS "R"—REFRIGERATOR CAR TYPE

"RM"—Beef Rail Refrigerator. A fully insulated house car equipped with either brine tanks or ice bunkers. Designed primarily for the use of combined crushed ice and salt and with or without means of ventilation.

Equipped with beef rails and used chiefly for fresh meat and packing house products.

"RS"—Bunker Refrigerator. A *fully insulated* house car equipped with ice bunkers. Designed primarily for use of chunk ice and with *or without* means of ventilation.

Blocking for Cradles of Car Dumping Machines

Your committee has prepared necessary corrections in the drawing shown between pages 44 and 45, Section L of the Manual, covering "Standard Blocking for Cradles of Car Dumping Machines," to provide clearance for additional grab handles now being applied to open-top cars. The text for this recommended practice has also been revised.

[Changes required in text were slight.—EDITOR.]

Letter Ballot Items

It is recommended that the following items be submitted to letter ballot:

Designs for standard Self-Clearing Hopper Cars of 50 and 70 tons nominal capacity.

Revision of standard specifications for Journal Box Lids.

Revision of design of standard Journal Bearing Wedges.

Revision of recommended practice covering standard Blocking for Cradles of Car Dumping Machines.

Revision of recommended practice Classification of Cars, Definitions and Designating Letters for.

The report was signed by P. W. Kiefer (chairman), chief engineer motive power and rolling stock, N. Y. C.; T. P. Irving (vice-chairman), engineer car construction, C. & O.; W. A. Newman, chief mechanical engineer, Can. Pac.; A. H. Fetters, general mechanical engineer, U. P.; J. McMullen, superintendent car department, Erie; F. A. Isaacson, engineer car construction, A., T. & S. F.; G. S. Goodwin, assistant general superintendent motive power, C. R. I. & P.; E. B. Dailey, engineer car construction, S. P.; B. S. Brown, general foreman, Penna.; K. F. Nystrom, superintendent car department, C., M., St. P. & P.; J. P. Laux, superintendent motive power, L. V., and H. L. Holland, assistant engineer, B. & O.

Discussion

In presenting the report Mr. Kiefer said that since the formal report was written the casting manufacturers had submitted drawings for alternate cast steel constructions of various groups of parts of the proposed hopper car designs and that the drawings were available for inspection by the members interested.

W. G. Black complimented the committee on its thorough and comprehensive report and moved a rising vote of thanks. He questioned the wisdom of using the same center sill section area in the hopper car design as in the box car, calling attention to the fact that there is a loss of 350 to 400 lbs. of weight per car annually due to corrosion and that a relatively much larger amount may have to be spent in reinforcements of an inadequate design than would be required to increase sill section at the outset. In reply Mr. Kiefer said that all the information the committee had secured bore out its recommendation that the same sill section be used for both types of cars. The new bolster center filler casting, he said, takes the end shocks solidly and that the question of adequate strength was really a matter of securing sufficient rivets in the connection between this casting and the sills. W. E. Dunham, superintendent of the car department, Chicago & North Western, said that the vertical end-lining boards were the cause of the condemnation for cereal loading of many cars on that road and that the only way in which refuse could be cleaned out from behind the end-lining in these cars was to remove the lining from the car. He said that the Chicago & North Western had come to the conclusion that the horizontal end-lining boards would be applied to future cars because of this difficulty. He also said that after continuous difficulty from center plate failures on hopper cars a 15-in. center plate had been adopted, and that this had completely overcome the difficulties from wheel wear and center plate failures experienced with the former 12-in. plates. R. L. Kleine pointed out that the 25¾-in. center plate height on the proposed standard hopper cars was a variation from standards which destroyed interchangeability. In reply Mr. Kiefer said that the new center plate height was the one with which the least stresses were produced in the underframe and, using which, the least weight in the structure was required. For these reasons, he said, the committee felt that the departure from the former standard was fully justified.

Action.—The report was accepted and recommendations referred to letter ballot.

Locomotive and Car Lighting

Your committee would report that co-operating with the Director of Research in his study on air conditioning of passenger cars, with particular reference to standardization of terminal servicing conditions, a meeting was held on October 3, 1934, and, as a result of the conference, recommendations were submitted by letter ballot—Circular No. D. V.—825—for adoption as recommended practice the following items:

1. That all stand-by motors on air conditioning cars be connected for operation on a 220-volt, 3-phase, 60-cycle source of power.

2. That plugs and receptacles be in accordance with attached detailed drawings. Plugs for use in electrified zones should be arranged so that the plug handle, to which the ground connection is made, is insulated from the housing and further that the housing be furnished with a projecting stop to prevent receptacle cover coming in contact with plug handle. These precautions have been found necessary in electrified zones to overcome difficulties encountered due to potential differences.

3. That leads from transformer to receptacle on right-of-way and cord and plugs be so connected that when T1, T2, and T3 on plug on car end of cord are connected to similarly marked motor leads, phase rotation will be clockwise when facing end of motor opposite compressor drive.

4. That receptacles in parallel be located on the car in such manner that the car may be readily serviced from either side.

The report was signed by: W. E. Dunham (chairman), superintendent car department, C. & N. W.; E. P. Chase, foreman, Penna.; O. M. Bixby, assistant engineer, N. Y. C.; E. Wanamaker, electrical engineer, C., R. I. & P.; A. E. Voigt, car lighting engineer, A., T. & S. F.; F. O. Marshall, electrical engineer, Pullman Co., and P. J. Callahan, supervisor car and locomotive electric lighting, B. & M.

Action.—The report was accepted.

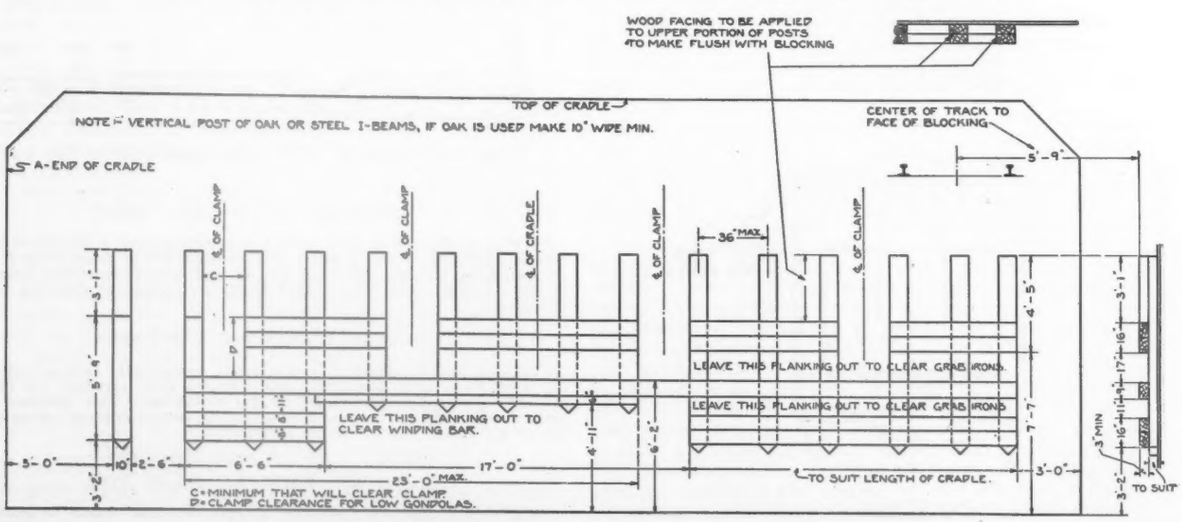


Fig. 7—Revised blocking for cradles of car dumping machines

Wheels

Chilled Iron Wheels

The Association of Manufacturers of Chilled Iron Car Wheels has been actively engaged in the development of the chilled-iron wheel. In order to facilitate detailed study of various factors entering into the manufacture and service of chilled-tread wheels this association has organized a research department to make a study of the material from which the wheel is constructed, improvements in design and performance of wheels in service. Developments to date have resulted in a mass of detailed data, as well as production of a design of cast-iron wheel of lighter weight than the present standard. Lightening has been accomplished primarily by coring the hub section and reducing the thickness of the plate. The reduction in plate thickness is compensated for by improvement in metallurgy and foundry practice, controlled heat-treatment playing a major part in improving the physical properties of the metal. If the improvement in the quality of the chilled car wheel proves equal to what the preliminary tests now indicate, it will be necessary to modify materially the specifications covering the normalizing process of the finished wheel.

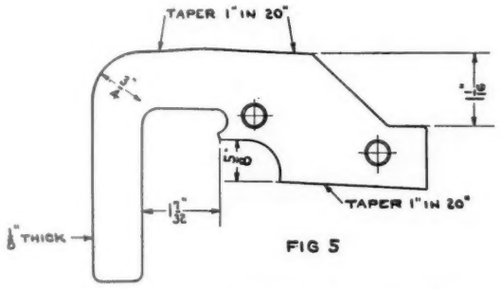


FIG 5

MAXIMUM FLANGE THICKNESS, HEIGHT AND THROAT RADIUS GAGE, MULTIPLE WEAR MACHINE FINISHED WROT STEEL WHEELS AND TIRES.

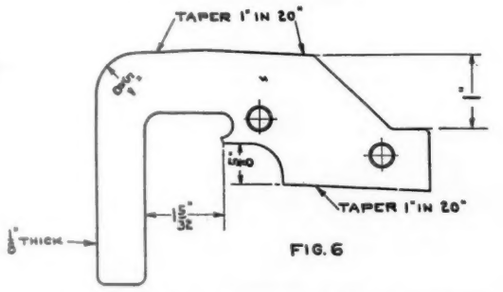


FIG. 6

MINIMUM FLANGE THICKNESS, HEIGHT AND THROAT RADIUS GAGE, MULTIPLE WEAR MACHINE FINISHED WROT STEEL WHEELS AND TIRES.

Proposed gages for machine-finished wrought-steel wheels

A few of these light-weight wheels have been applied to 50-ton light-weight box cars, and the committee has been requested to approve the use of a limited number of such wheels in interchange. This was gladly done as the committee is heartily in accord with the effort of the manufacturers. These light-weight wheels are identified by the marking "A. A. R. X."

The Association of Chilled Iron Wheel Manufacturers, in an endeavor to strengthen the rim, has added ¼ in. to the inside surface of the rim, the metal being obtained from the hub and the junction of the hub and plate sections. A limited number of such wheels, by consent of the purchaser, have been furnished and placed in service. The Wheel Committee has recommended that wheels of this type representing experimental design be marked "A. A. R. X." to indicate them as such. Note under Rule 3, Code of Rules, provides for wheels of experimental design thus marked to be accepted in interchange. The committee is awaiting with interest the result of this strengthening of the rim section. Until more information is available as to the advantage of this change no alterations will be made in the existing standard design.

The committee is not prepared to make recommendation for the adoption of a straight-taper tread for cast-iron wheels. An extended test of such wheels is being continued by one road for the committee's information. It now has about 20,000 of these wheels in service under refrigerator cars. In general, it must be said that the results with this type of tread are encouraging, but sufficient data is not yet available to warrant final report.

Gages and Their Application

There appears to be some misunderstanding on the part of some of the roads regarding the application of the Worn Through Chill Gage. The question has been raised as to the application of the gage to cars in transportation yards. In answering inquiries on this subject the committee has taken the position that a wheel worn through chill represents a condemning defect the same as any other condemning defect, and where such a condition obtains, the handling line is justified in applying the Worn Through Chill Gage to cars in transportation yards the same as to cars on shop track. A worn through chill wheel is a condemnable defect, and should be removed from service when condemned by application of the proper gage. Application of the Worn Through Chill Gage can only condemn when the wheel is actually worn through the chill; *it must not be applied for condemning a wheel out of round where worn through chill does not exist.*

Recommendation has been made to the committee that a remount limit be established for worn through chill wheels to take care of a condition where one wheel of a pair is worn through chill, yet the mate wheel will not take the condemning limit gage. In a condition of this kind the Tread Worn Hollow Remount Gage should, in the majority of instances, take care of the situation satisfactorily. The committee is not favorable to adding to the already large number of wheel defect gages that have been devised to take care of the varying classes of defects that occur in wheel service.

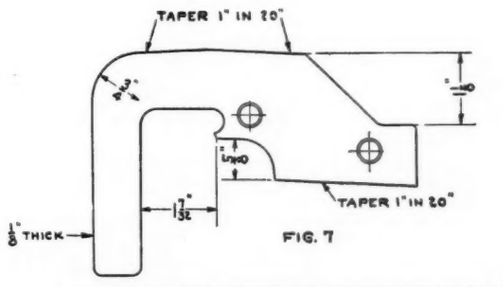


FIG. 7

MAXIMUM FLANGE THICKNESS, HEIGHT AND THROAT RADIUS GAGE, MULTIPLE WEAR ROLL FINISHED WROT STEEL WHEELS AND TIRES.

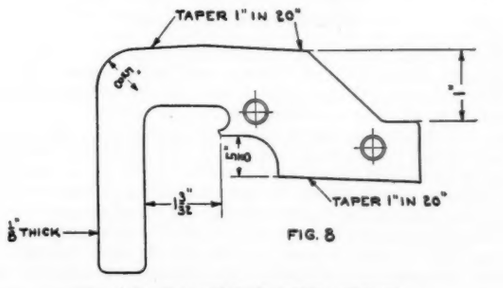


FIG. 8

MINIMUM FLANGE THICKNESS, HEIGHT AND THROAT RADIUS GAGE, MULTIPLE WEAR ROLL FINISHED WROT STEEL WHEELS AND TIRES.

Proposed gages for roll-finished wrought-steel wheels

Gages for Multiple-Wear Wrought-Steel Wheels and Tires

On Page 23 of the 1935 revision of the Wheel and Axle Manual are shown Figs. 7 and 8 as tentative Maximum and Minimum Flange Thickness, Height and Throat Radius Gages for Multiple-Wear Wrought-Steel Wheels and Steel Tires. These gages were so designed that they might be used for gaging either machine or roll finished wheels by using a 1/16 in. thickness feeler which is provided on the end of each gage. This arrangement was suggested to limit as far as practicable the number of wheel gages which, as previously mentioned, seem to be increasing each year. There have been some objections raised to this combination of gages because of the confusion that may arise

in their application, and it must be admitted this is not unlikely. Your committee has therefore prepared drawings for the construction of two sets of gages, one to apply to machine-finished and the other to roll-finished wheels.

Machine Shop Practice

In the revision of the Wheel and Axle Manual the committee made special effort to amplify the information previously published with respect to wheel shop practices. It is the general opinion there is still an opportunity for marked improvement in the machining of axles and wheels for mounting, and in mounting practices. This applies not only to railroads, but to commercial plants engaged in wheel mounting. There are altogether too many otherwise serviceable wheels being removed because there is indication they may be loose on the axle because of oil spots appearing on the inside face of the hub and plate of the wheel. Comparatively few wheels with such markings are found either actually loose or approaching such a condition, but such an indication, with proper consideration for safety cannot be disregarded, and this is leading to unnecessary removal because of improper machine-shop practice in mounting wheels. In order further to accelerate interest with respect to improving wheel-shop practices it is recommended that A. A. R. mechanical inspectors give special consideration to the manner in which machine work is being performed in the preparation of wheels and axles for mounting, as well as to the manner in which mounting pressures are being developed.

One-Wear Wrought-Steel Wheels

In 1934 your committee presented specifications covering one-wear solid wrought-steel wheels. These were later adopted by letter ballot. Since adoption of the 1934 one-wear solid wrought-steel wheel specification the Wrought Steel Manufacturers Technical Committee has conferred with your committee and requested certain modifications in the specifications in order to facilitate production, and at the same time maintain the price on an attractive basis.

After consideration and following joint sessions with the manufacturers' representatives your committee recommends the following specification revisions:

[These revisions comprehend a change in the carbon range from the present 0.67 to 0.82 per cent, to 0.65 to 0.85 per cent; an increase from 1/16 in. to 3/32 in. in the tolerance under the specified thickness of flange; the inclusion of the letters "AAR" in the identification marking; mating by ½-tape sizes, and revisions in manual references to bring the manual and specifications into conformity.—EDITOR.]

Thermal Checking

Reference has been made in previous reports to the thermal checking of wrought-steel wheels and failures that result from this development. This subject was given prominent place in discussions with the manufacturers' representatives. It is the opinion of your committee that while thermal checking may originate from a thermal condition developed in braking, the further development from such surface checking is not as liable to produce a wheel failure if the wheels have been relieved of internal stresses set up in the process of manufacture.

The manufacturers, in recognition of the serious developments that may obtain from thermal cracks, are actively engaged in developing methods for relieving the wheels of forging stresses after forming as well as developing special materials that may be less sensitive to the thermal conditions under which thermal cracks originally develop. It is encouraging to observe that considerable advancement is being made along these two lines.

[The committee reported that it had been engaged in an extensive revision of the Wheel and Axle Manual preparatory to its reprinting, and that it had formulated a proposed list of symbols to apply to axle defects similar in principle to those already in effect for identifying wheel defects.—EDITOR.]

Mating Wheels to Closer Diameters

The committee wishes to emphasize the importance of mounting wheels to closer diameters as expressed in tape sizes. This matter has been discussed with the Chilled Iron Wheel Manufacturers with respect to marking wheels in one-half tape sizes. The manufacturers have agreed to this practice and will white-stencil tape sizes on wheels conforming to the following arrangement:

	White Stencil
Tape 2	20
Tape 2½	25
Tape 3	30
Tape 3½	35
Tape 4	40 etc.

In addition to the white stenciling in recognizing one-half tape sizes, the tape-size nibs cast on the wheels will be cut according to the tape size representing the left-hand figure of the stenciled tape size; for instance, stencil tapes 20 and 25, chip all but 2 nibs; stencil tapes 30 and 35, chip all but 3 nibs, etc.

The question of taping and pairing wheels to one-half tape sizes was discussed with representatives of the Wrought Steel Wheel Manufacturers as well as the Cast Steel Wheel Manufacturers, and the manufacturers were agreeable to adopting this practice. The one-half tape sizes will be indicated by the figure "5" following the full tape size; 157½ tape will be indicated 157-5, 158½ tape, 158-5, etc.

In the revisions recommended for the one-wear wrought-steel wheel specification, mating wheels to one-half tape sizes will be included. This revision in the multiple-wear wrought-steel wheel specification and the cast-iron wheel specification can be taken care of when these specifications require revision on account of more extensive changes.

The standard wheel tape is not graduated in one-half tape sizes, but it is the opinion of the committee there will be no difficulty in interpolating one-half tape sizes in the process of taping the wheels, and that good results will attend the necessary effort in thus endeavoring to get the wheels mounted to closer diameters.

Cast-Steel Wheels

Two prominent cast-steel manufacturers have furnished a limited number of multiple-wear cast-steel wheels. Some of these multiple-wear wheels have been placed in exacting locomotive tender service and the committee earnestly solicits from the roads observing the performance of these wheels the results of service developments.

These same manufacturers are also in position to supply one-wear cast-steel wheels, the wheels to conform to the same design and specified dimensions as outlined in the specification for one-wear wrought-steel wheels adopted in 1934.

Recommendations

The following is a summary of the committee's recommendations to the association:

1. *Maximum and Minimum Flange Thickness, Height and Throat Radius Gages*—Recommendation is made for the adoption of Maximum and Minimum Flange Thickness, Height and Throat Radius gages for new multiple-wear wrought-steel wheels and steel tires as shown for machine-finished and for roll-finished wheels.

2. *Symbols for Axle Defects*—It is recommended that the symbols covering axle defects as outlined be submitted for approval.

3. *One-Wear Wrought-Steel Wheel Specification*—The suggested revisions in the One-Wear Wrought Steel Wheel Specification as outlined in detail in this report should be submitted for approval. It is also recommended that in order to accommodate the change in the flange thickness tolerance for the one-wear wrought-steel wheel the flange thickness feature of the gage shown in Circular DV-807 as Fig. 5 should be revised to show two dimensions as herein recommended—one dimension to apply to cast-iron and one-wear cast-steel wheels, the other to apply to one-wear wrought-steel wheels.

The report was signed by H. W. Coddington (chairman), chief chemical and test engineer, N. & W.; D. Wood (vice-chairman), engineer tests, So. Pac.; C. T. Ripley, chief mechanical engineer, A., T. & S. F.; O. C. Cromwell, assistant to chief, motive power and equipment, B. & O.; E. C. Hardy, general inspector, N. Y. C.; A. M. Johnsen, engineer tests, Pullman Co.; J. Matthes, chief car inspector, Wabash; C. Petran, supervisor tools and machinery, C., M., St. P. & P., and M. R. Reed, general superintendent motive power, central region, Penna.

Discussion

J. McMullen, superintendent car department of the Erie, complimented the committee on its report, but questioned the recommendation regarding the limited use of the worn-through-chill gage, stating that some gage must be available for use in checking and condemning out-of-round wheels, which are now causing excessive maintenance expense owing to broken brasses, brake beams, etc., as well as damage to lading. L. Richardson, mechanical superintendent, Boston & Maine, supported this contention regarding the need for an eccentric wheel gage. Mr. Coddington explained that the worn-through-chill gage is not designed to detect eccentric wheels or wheels which are out-of-round for any other reason than being worn through chill. Mr. Ripley stated that other factors than out-of-round wheels are frequently responsible for damage to equipment and lading and suggested that it may be cheaper for the railroads to improve spring conditions rather than to place the entire blame on the wheels and develop an eccentric or out-of-round wheel gage which would condemn a substantial percentage of car wheels now in service. He said that he is not opposed to the idea of an eccentric wheel gage, but suggested that its design must be developed with the greatest

care in order to avoid a prohibitive cost for wheel renewals.

In connection with the one-wear wrought steel wheels for 6 in. by 11 in. axles referred to in the committee's report, R. L. Kleine, assistant chief of motive power (car) of the Pennsylvania, stated that 4,000 of these wheels have been placed in service on the Pennsylvania in a year and that the specification should be revised to incorporate this design as soon as possible without waiting for a more general use of this type of wheel.

Action.—The report was accepted and necessary recommendations ordered submitted to letter ballot.

Tank Cars

During the year, the committee considered a total of 214 dockets and applications for approval of designs, of which 129 covered shipping containers of 12 different classes for application to 1,163 new or existing cars. Two applications covered eight multi-unit cars to be used for the transportation of 15 Class I.C.C. 106-A-500 one-ton containers each. Sixty-seven applications covered alterations to existing equipment, such as applications of insulated dome covers, bottom outlets, steam-heat coils, etc., a total of 1,209 cars of six classes being involved. Fifteen applications for the approval of tank car appurtenances, such as one-inch angle valves, dome covers, discharge valves, etc., were considered; also one application for proposed specifications for fusion-welded anchor rivet covers.

At a public hearing presided over by the director, Bureau of Service, I. C. C., the committee and others interested presented testimony in support of their recommendation that the 21 proposed fusion-welded shipping containers covered by pending applications be approved for experimental service trials. At this same hearing, specifications were recommended to cover fusion-welded containers mounted on and forming part of a car. To date, the I. C. C. has not indicated their disposition of these recommendations.

As a result of continued unfavorable conditions, the committee has recommended to the Arbitration Committee the extension for a period of one year of the effective date of interchange rules covering head-block anchorage, wooden shims between the center anchorage and the underframe and method of securing dome covers to tanks by means of a hinge or chain.

A subcommittee on safety valves has continued to give consideration to the development of a safety valve which will overcome the objections to the present standard valve, which develops a slight leakage before reaching the safety valve setting.

The committee has continued its study of methods of patching tank-car tanks but, due to many factors involved, is not prepared to submit recommendations.

The matter of safety valves for 105-A Series tank cars has been considered. The Chlorine Institute, Inc., is actively engaged in developing a satisfactory safety valve for use on cars transporting chlorine and has conducted a number of tests of proposed designs. As all these tests have not been concluded, no definite recommendations are submitted.

In its last report, the committee called attention to the failures of two tank cars used for the transportation of chlorine. Investigations of the causes of these failures have resulted, in one case, in improved manufacturing methods. In the other case, involving a tank with an anchorage of an obsolete design, owners of similar tanks were informed of the potential hazard involved in their continued use in transportation service. The voluntary retirement of some 18 tanks having anchorages of similar design is highly commendable and indicative of the industry's desire to co-operate in the interest of safety.

Since its last report, the committee has caused to be conducted one additional investigation of the failure of a chlorine tank. Report of this investigation indicated the necessity for improved manufacturing methods. The necessary corrective measures have been taken to prevent a reoccurrence.

Specifications for Tank Cars

Your committee recommends submission to letter ballot of modifications of A. A. R. paragraphs of the specifications for tank cars in accordance with the following proposed forms:

(a)—Class I. C. C. 103. *A. A. R.-4 (e). When tank is divided into compartments, the interior heads must not be less than the minimum thickness specified for interior compartment heads. When capacity of tank is reduced by application of additional interior head and end head adjacent thereto does not meet all the requirements for exterior tank heads applied in accordance with these specifications, then the additional interior head must not be less than the minimum thickness specified for exterior tank heads. Voids, created by the addition of heads for division into compartments and/or reduction in capacity, should be provided with a tapped drain hole at their lowest point. This drain hole to have standard ¾-in. pipe threads and be fitted with a ¾-in. solid plug.*

(b)—Class I. C. C. 103-A. A. A. R.-4 (e). *Same as Specification 103.*

(c)—Class I. C. C. 103-B. A. A. R.-4 (e). *Same as Specification 103.*

(d)—Class I. C. C. 103-C. A. A. R.-4 (e). *Same as Specification 103.*

(e)—Class I. C. C. 104. A. A. R.-4 (e). *Same as Specification 103.*

Reason.—To clarify the intent and to secure safety in transit.

(f)—Class I. C. C. 103. A. A. R.-16. *Solid plugs must be so indicated by having a raised S cast integral on the face or top of the square head.*

(g)—Class I. C. C. 103-A. A. A. R.-16. *Same as Specification 103.*

(h)—Class I. C. C. 103-C. A. A. R.-16. *Same as Specification 103.*

(i)—Class I. C. C. 104. A. A. R.-16. *Same as Specification 103.*

(j)—Class I. C. C. 104-A. A. A. R.-16. *Same as Specification 103.*

Reason.—To require the use of a permanent identification mark signifying compliance with the requirements of the I. C. C. Shipping Container Specifications.

(k)—Class I. C. C. 103. A. A. R.-14 (a). Safety valve must be of approved design. See Fig. 2 and A. A. R. Paragraph 18 (a).

For vent *closure* see Fig. 3. *This closure must be so chained as to prevent misplacement.*

(l)—Class I. C. C. 103-A. A. A. R.-14 (a). For vent *closure* see Fig. 3. *This closure must be so chained as to prevent misplacement.*

Reason.—To clarify the intent and in the interest of safety.

(m)—Class I. C. C. 103-B. A. A. R.-14 (a). Eliminate this paragraph from specification.

Reason.—Design of vent closure illustrated by Fig. 3 is not used on Class I. C. C. 103-B tank cars and to promote safety in transit.

(n)—Class I. C. C. 103-C. A. A. R.-14 (a). Safety valves must be of approved design. For vent *closure* see Figure 3. *This closure, when used, must be so chained as to prevent misplacement.*

(o)—Class I. C. C. 104. A. A. R.-14 (a). *Safety valves must be of approved design. For vent closure see Fig. 3. This closure, when used, must be so chained as to prevent misplacement.*

A. A. R.-14 (b). *Same as Specification 103.*

Reason.—To clarify the intent and to promote safety in transit.

(p)—Your committee is also recommending to the Interstate Commerce Commission a modification in their shipping container specifications to require Class I. C. C. 105-A series containers to be inspected during fabrication and reports of same filed with all interested parties.

Changes in the Rules of Interchange

In its annual report for 1932 your committee suggested that the Rules of Interchange be modified to require owners to bring existing tank car underframes, at the time new tanks are mounted thereon, into compliance with the A. A. R. requirements for Class III tank cars, effective May 1, 1917, to July 1, 1927.

This proposal was subsequently submitted to the Arbitration Committee, adopted and incorporated in the Rules of Interchange (See Rule 3, Sec. (t), Par. (14).

It is now recommended that the present requirement of the Rules of Interchange be modified in accordance with the following Proposed Form: (14) Tank Cars.—In the application of new tanks to second-hand underframes and trucks, the *car structure* must at least conform to the A. A. R. Specifications for Tank Cars effective *March 1, 1931;* and truck must be equipped with cast-steel side frames meeting *A. A. R.* Specifications. From owners.

Reason.—The Proposed Form covers desirable requirements which should be met at the time new tanks are applied and which are not included in the Specifications for Class A. A. R.-III tank cars.

It is recommended this proposition be submitted to the Arbitration Committee.

Changes in the I. C. C. Regulations

Interstate Commerce Commission Order No. 3666, dated June 18, 1932, contained the following modification of paragraph 243 (c) of their Regulations for Transportation by Rail of Explosives and Other Dangerous Articles by Freight:

"Effective on and after October 1, 1932, no tank car manhole closure of screw type with or without vent holes, or of any other design, shall be permitted on any tank car being used in the transportation of any material described in sub-paragraph (a) or (b) of this regulation, unless

the closure is equipped with approved safeguard making its removal from manhole opening practically impossible while car interior is subjected to vapor pressure of the lading."

In order that all interested parties may be informed of the owners compliance with the foregoing requirement your committee is recommending that the Bureau of Explosives give consideration to a proposed modification of same, to require tank cars so equipped to be distinctively marked.

The report was signed by: G. S. Goodwin (chairman), assistant to general superintendent of motive power, C., R. I. & P.; F. A. Isaacson (vice-chairman), engineer of car construction, A., T. & S. F.; A. G. Trumbull, chief mechanical engineer, C. & O.; G. McCormick, general superintendent of motive power, So. Pac.; W. C. Lindner, chief car inspector, Pennsylvania; A. E. Smith, vice-president, Union Tank Car Co.; G. E. Riley, assistant traffic manager, General Chemical Co.; C. C. Meadows, master car builder, Tide Water Oil Co.; G. A. Young, head, school of mechanical engineering, Purdue university; F. Zeleny, engineer of tests, C., B. & Q., and W. C. Steffa, transportation manager, Sinclair Refining Co.

Action.—The report was accepted and necessary recommendations referred to letter ballot.

Locomotive Construction

The Committee on Locomotive Construction has, during the year, given consideration to the following 15 subjects:

A—Design of fundamental parts of locomotives: Locomotive axles; driving-wheel centers of thin wall-section type; safety valves for locomotives; light-weight pistons.

B—Design of and repairs to locomotive springs.

C—Advantages and disadvantages of higher boiler pressures.

D—Roller bearings for locomotives and tenders.

E—Driving and trailer tires.

F—Code of rules to govern the movement and handling of locomotives which failed on the road due to broken parts.

G—Code of rules to govern the preparation of locomotives for storage in good order and care of locomotives while in storage.

H—Code of rules to govern firing-up of locomotives.

I—Exhaust-steam injectors and exhaust-steam feedwater heaters.

J—Development and use of oil-electric locomotives.

K—Failed parts of locomotives and method of reporting, analyzing and correcting such failures.

L—Report of builder's subcommittee on method of determining locomotive weight distribution.

It is recommended that the following six subjects be submitted to letter ballot for adoption as recommended practice:

Spring-hanger clips for locomotive elliptic springs.

Code of Rules to govern the movement and handling of locomotives which fail on the road due to broken parts.

Code of Rules to govern the preparation of locomotives for storage in good order and care of locomotives in storage.

Code of Rules to govern firing-up of locomotives.

Method of analyzing and correcting failed parts of locomotives.

Method of determining locomotive weight distribution.

In addition the committee has given consideration to the reports of the Federal Co-ordinator of Transportation, dated April 24, 1934, and June 9, 1934, on the subject of steam locomotives. Report covering the committee's consideration of this subject has been made to the General Committee.

Locomotive Axles

In 1934, the Committee on Fundamental Parts of Locomotives submitted information on locomotive axles and mentioned a special design of built-up driving axle in use on the D., L. & W. The Lackawanna reports that axles of this composite construction are rendering good service and are affording satisfactory protection against axle failures which they were designed to prevent.

Driving Wheel Centers with Thin Walls

In 1934, your committee included a statement of railroads which had applied driving-wheel centers of thin-wall section types and gave other information as to the diameter of wheels, types of locomotives, etc., on which these wheel centers were in use. This statement has been brought up to date as of December 31, 1934, and is herewith submitted.

[Tabulated data showed the application of 186 driving-wheel centers of the double-disc type to 83 locomotives on 17 roads; the application of 524 driving-wheel centers of the Boxpok type to 212 locomotives on 18 roads, and also the application of two wheel centers each of the Birdsboro thin-wall type and of the Univan type.—EDITOR.]

Inquiry as to the service rendered by the various types of special wheel centers has been made and your committee finds that, with few exceptions, the service rendered is reported as satisfactory. A few defects have been reported but they were said to be of a nature common to steel castings and the number smaller than would be expected of an equal number of ordinary design. Wheel centers of various thin-wall section types are still regarded as in the experimental stage on practically all the roads reporting; hence the committee offers no definite conclusions or recommendations.

Safety Valves

During the past two years, your committee has been considering the subject of safety valves for locomotives and has collected information from a large number of representative roads, as well as from locomotive builders and principal manufacturers. The information now carried in Section F of the Manual has also been considered.

As a result, the committee offers the following for consideration. This report is one of progress only, as there are a number of matters which should be given further consideration but which will require more time in which to obtain the information.

Safety valves used on locomotive boilers must conform to I. C. C. rules 34 to 36, inclusive.

The aggregate discharge capacity of all safety valves on any locomotive boiler must be equal to the maximum steam generating capacity of the boiler. The following formula will approximate the evaporative capacity of the average locomotive boiler:

W = 5.75 S.
W = Evaporative capacity of boiler in pounds of steam per hour.
S = Total evaporative surface in square feet.

For boilers having large grate area or short flues, the evaporative capacity should be calculated according to the formulas commonly used for determining boiler capacity in connection with steam consumption, and, in cases of doubt or boilers of unusual construction, the evaporative capacity should be determined by actual test.

Manufacturers of safety valves should be required to furnish, for each safety valve offered for sale, a table giving the following information:

a—Range of pressures through which the safety valve is designed to operate.
b—The rates of discharge capacity of the safety valve in pounds per hour for the various pressures within its range.
c—Identification numbers or symbols designating the different springs used in the safety valve and the range of pressures through which each spring is to operate.

The size and number of safety valves to be used on any given boiler is to be determined from the maximum evaporative capacity of the boiler and the rated discharge capacities of safety valves as given by the manufacturers for the pressure to be carried on the locomotive.

Each safety-valve spring should be plainly marked by the manufacturer to designate make, type and size of safety valve in which it is to be used and range of pressures through which it is to operate.

No safety valve is to be set for any pressure outside of the range stamped upon the spring used within it.

When applying safety valves they should be located as high above the water level as clearance limitations will permit, preferably above the point where the height of steam space above the water is least influenced by gradients.

Safety valves should be applied in a vertical position if possible, and openings for them in dome cap or boiler should not be spaced closer than shown on page 73, Section F of the Manual.

Each safety valve should have a full-size direct connection to the boiler or steam dome. If safety valves are mounted upon a manifold or auxiliary dome, the area of the opening between the boiler and dome must be not less than the combined areas of the inlet opening in the bases of safety valves mounted thereon.

Safety-valve bases should be of the female type and applied to suitable brass sleeves screwed into the boiler or steam dome, the threading of safety-valve bases and sleeves to conform to the railway company's standards.

Safety-valve bases are to be provided with hexagonal wrench fits.

Locomotive safety valves should be set to open at pressures as indicated in the following table:

Number of Safety Valves on Boiler	Pops Set to Open at			
	1st or working pop	2nd pop	3rd pop	4th pop and all others
2	Working press.	Working press. plus 2 lb.		
3	Working press.	Working press. plus 2 lb.	Working press. plus 5 lb.	
4 or more	Working press.	Working press. plus 2 lb.	Working press. plus 4 lb.	Working press. plus 6 lb.

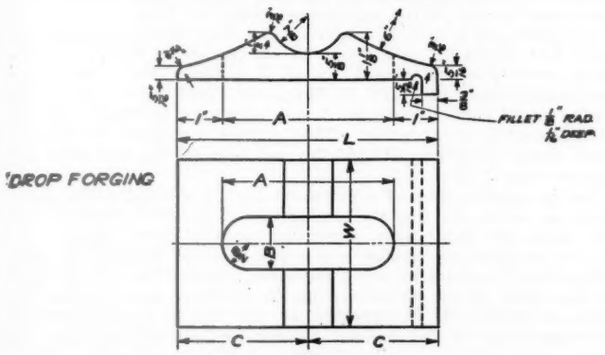
Safety valves should be designed and adjusted to close with the

least possible reduction in pressure consistent with durability and satisfactory relieving capacity. In no case should the reduction in pressure required for closure amount to more than 2 per cent of the pressure at which the safety valve is set to open.

Locomotive Springs and Hanger Clips

When the subject "Proposed standard hanger slots for locomotive springs," was assigned to the subcommittee, they were furnished the following information from Alan N. Lukens of the Railway Steel Spring Division of American Locomotive Company, member of the Manufacturers Committee, which was recommended by the locomotive builders committee together with drawings of spring clips for regular- and inverted-camber springs.

SPRING HANGER CLIP FOR SWORD HANGER USED WITH REGULAR CAMBER ELLIPTIC LOCOMOTIVE SPRINGS.



CLIP NUMBER	WIDTH W	SLOT A	SLOT B	℄ TO END C	LENGTH L	CLIP NUMBER	WIDTH W	SLOT A	SLOT B	℄ TO END C	LENGTH L
1	3"	3½"	1⅛"	2¾"	5½"	19	5½"	4½"	1½"	3¼"	6½"
2	3½"	3½"	1⅛"	2¾"	5½"	20	"	4½"	1⅞"	3¼"	6½"
3	3½"	3½"	1⅛"	2¾"	5½"	21	"	5"	1½"	3½"	7"
4	"	3½"	1½"	2¾"	5½"	22	"	5⅛"	1⅞"	3⅝"	7⅛"
5	"	4"	1⅛"	3"	6"	23	6"	4½"	1⅞"	3¼"	6½"
6	4"	3½"	1⅛"	2¾"	5½"	24	"	5"	1½"	3½"	7"
7	"	3½"	1½"	2¾"	5½"	25	"	5⅛"	1⅞"	3⅝"	7⅛"
8	"	4"	1⅛"	3"	6"	26	"	5⅛"	1⅞"	3⅝"	7⅛"
9	"	4"	1½"	3"	6"	27	"	6"	1⅛"	4"	8"
10	4½"	3½"	1½"	2¾"	5½"	28	7"	4½"	1⅞"	3¼"	6½"
11	"	4"	1⅛"	3"	6"	29	"	5⅛"	1⅞"	3⅝"	7⅛"
12	"	4"	1½"	3"	6"	30	"	5⅛"	1⅞"	3⅝"	7⅛"
13	"	4½"	1½"	3¼"	6½"	31	"	6"	1⅛"	4"	8"
14	5"	4"	1½"	3"	6"	32	8"	5⅛"	1⅞"	3⅝"	7⅛"
15	"	4½"	1½"	3¼"	6½"	33	"	5⅛"	1⅞"	3⅝"	7⅛"
16	"	4½"	1⅞"	3¼"	6½"	34	"	6"	1⅛"	4"	8"
17	"	5"	1½"	3½"	7"						
18	"	5⅛"	1⅞"	3⅝"	7⅛"						

DIMENSIONS OF CLIPS

Fig. 1—Spring hanger clips for regular-camber springs

[Tables A, B and C which are a quite comprehensive study of the problem and include 1015 designs of springs, have been omitted from this abstract.—EDITOR.]

As the assignment covers only the design of elliptic spring hanger clips, we are confining our report to this phase of the subject.

The committee recommends for adoption as recommended practice the clips, Figs. 1 and 2.

Higher Boiler Pressures

MULTIPLE-PRESSURE LOCOMOTIVES

New York Central.—Insofar as the multiple-pressure 250-850 lb. three-cylinder 4-8-4 type locomotive No. 800 is concerned, there is nothing to add to the report for 1934 except that the locomotive was placed in road service in December, 1934, for the purpose of gaining actual operating experience, no attempt having been made to determine fuel or other economies.

WATER-TUBE FIREBOX BOILERS

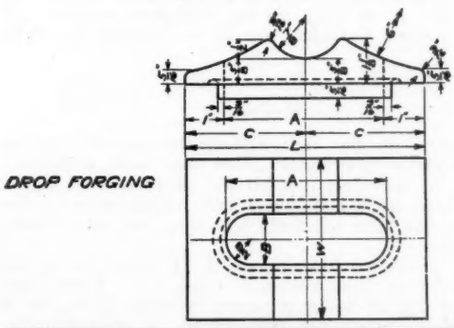
Baltimore & Ohio.—The B. & O. has practically standardized on 350 lb. pressure for all new complete boilers for modernized and new equipment.

Locomotives 5550 and 7450 equipped with the conventional staybolt fireboxes and mentioned in previous report have made 382,000 and 192,000 miles respectively since they were placed in service, or about the same mileage obtained from locomotives 5510 and 7400 with water-tube fireboxes. For further research purpose, locomotive 5550 is now equipped with B. & O. semi-water tube firebox, consisting of troughs in the crown and side circulating tubes in addition to the arch tubes; while firebox of locomotive 7450 is equipped with arch tubes only.

Since the preparation of the previous report, based on economical operation and maintenance of high-pressure combined fire-tube and water-tube firebox boilers on locomotives in freight and passenger service, the B. & O. has built two additional boilers of this type operating at 350 lb. pressure. These boilers are applied to the high-speed 4-4-4 and 4-6-4 type-class J-1 and V-2-locomotives with 84-in. drivers, and will haul the streamline cars under construction.*

They also have under construction another new boiler which will be practically the same as applied to the 4-6-4 type, Class V-2, locomotive built in 1933. This boiler will also operate at 350 lb. pressure. The locomotive will be equipped with 80-in. drivers and have 52,000 lb. tractive force. This is the ninth locomotive with water-tube firebox boiler the B. & O. has constructed since in 1927; the others have a mileage performance up to a total of 1,459,283 miles in February, 1935. All are

SPRING HANGER CLIP FOR SWORD HANGER USED WITH INVERTED CAMBER ELLIPTIC LOCOMOTIVE SPRINGS.



CLIP NUMBER	WIDTH W	SLOT A	SLOT B	℄ TO END C	LENGTH L	CLIP NUMBER	WIDTH W	SLOT A	SLOT B	℄ TO END C	LENGTH L
1	3"	3½"	1⅛"	2¾"	5½"	19	5½"	4½"	1½"	3¼"	6½"
2	3½"	3½"	1⅛"	2¾"	5½"	20	"	4½"	1⅞"	3¼"	6½"
3	3½"	3½"	1⅛"	2¾"	5½"	21	"	5"	1½"	3½"	7"
4	"	3½"	1½"	2¾"	5½"	22	"	5⅛"	1⅞"	3⅝"	7⅛"
5	"	4"	1⅛"	3"	6"	23	6"	4½"	1⅞"	3¼"	6½"
6	4"	3½"	1⅛"	2¾"	5½"	24	"	5"	1½"	3½"	7"
7	"	3½"	1½"	2¾"	5½"	25	"	5⅛"	1⅞"	3⅝"	7⅛"
8	"	4"	1⅛"	3"	6"	26	"	5⅛"	1⅞"	3⅝"	7⅛"
9	"	4"	1½"	3"	6"	27	"	6"	1⅛"	4"	8"
10	4½"	3½"	1½"	2¾"	5½"	28	7"	4½"	1⅞"	3¼"	6½"
11	"	4"	1⅛"	3"	6"	29	"	5⅛"	1⅞"	3⅝"	7⅛"
12	"	4"	1½"	3"	6"	30	"	5⅛"	1⅞"	3⅝"	7⅛"
13	"	4½"	1½"	3¼"	6½"	31	"	6"	1⅛"	4"	8"
14	5"	4"	1½"	3"	6"	32	8"	5⅛"	1⅞"	3⅝"	7⅛"
15	"	4½"	1½"	3¼"	6½"	33	"	5⅛"	1⅞"	3⅝"	7⅛"
16	"	4½"	1⅞"	3¼"	6½"	34	"	6"	1⅛"	4"	8"
17	"	5"	1½"	3½"	7"						
18	"	5⅛"	1⅞"	3⅝"	7⅛"						

DIMENSIONS OF CLIPS

Fig. 2—Spring hanger clips for inverted-camber springs

based on the same general design, with steam-drum roof, side walls with double rows of tubes set in header with wash-out plugs set opposite the ends of tubes.

Delaware & Hudson.—At this time there is nothing specific to report; observations and records are in accord with previous findings, namely, there is no distinctive difference from a maintenance standpoint developed by the use of boiler pressures up to 300 lb. in the normal type boiler. With the 325 lb. normal boiler, the service period has not been sufficient to warrant a statement at this time. The status of water-tube boilers is as heretofore.

However, it may be summarized that with these conventional and water-drum-tube firebox boilers carrying 260 to 500 lb., no unusual difficulties have obtained in maintenance. In other words, there has been no development that would necessitate a reduction in any of the boiler pressures as indicated and for which boilers were originally designed. To date, the practice has been to go as high as 325 lb. pressure for the conventional

* Descriptions of these locomotives were given in the May, 1935, issue of the *Railway Mechanical Engineer*.

design, and from 350 to 500 lb. pressure for the water-drum-tube design.

Performance on D. & H.—Consolidation type, triple-expansion, freight locomotive No. 1403, carrying 500 lb. boiler pressure, when hauling 3,500 actual tons in a northbound train from Oneonta to Mechanicsville, N. Y., a distance of 87 miles, in 3 hr., 50 min., with no stop over 0.5 and 0.8 per cent compensated grade lines, uses 5 tons of bituminous coal, and 10,500 gal. of water. The total weight of engine and train is 3,830 actual tons, and the fuel consumption averages 30 lb. of coal per 1,000 g. t. m. Pacific type, single-expansion, passenger locomotive No. 653, 325 lb. boiler pressure, when handling a train of 13 cars weighing 700 tons, from Whitehall to Green Island (Troy), N. Y., a distance of 77 miles, with one 3-minute stop and two speed restrictions, in 1 hr. and 45 min., over a line which includes 6 miles of 0.5 per cent grade, will make the run on 4,400 lb. of mixed 50 per cent anthracite buckwheat, and 50 per cent bituminous run-of-mine coal. The weight of the engine and train is 920 tons and the average fuel consumption is 4.4 lb. per car mile, or 55 lb. per 1,000 g. t. m., including weight of locomotive. Both of these locomotives are equipped with poppet valves and outside rotary-cam valve gear, and on the No. 653 the steam is released from the cylinders at 97 per cent of the stroke when starting, and at 93 per cent of the stroke when operating at cutoffs of from 3 to 60 per cent. The cylinder back pressure will range from 2 to 4 lb., the engine is exceptionally free steaming with a 7½-in. diameter circular exhaust nozzle, and at 60 m. p. h. the smokebox vacuum will average 6 in. of water. Cylinders are 22 in. diameter by 32 in. stroke.

Stayed Boilers

Canadian Pacific.—As the high-pressure locomotives become older, the information previously given has been confirmed, which is, briefly, to the effect that all the advantages of higher boiler pressure have been maintained and maintenance of the alloy-steel boilers has been relatively less than for low-pressure carbon-steel boilers.

Chesapeake & Ohio.—In 1930, the C. & O. placed in service forty 2-10-4 type locomotives, known as Class T-1. These locomotives operate at 265 lb. boiler pressure, cylinders 29 in. by 34 in., driving-wheel diameter over tires 69 in., a tractive force, 93,350 lb., to which is added 15,275 lb. for the booster. The locomotive boilers are equipped with nickel-steel shell courses and to date have given a good account of themselves with no trouble due to nickel-steel boiler shells. They were also equipped with steel staybolts in the water space and to date no trouble has been experienced therewith.

The coal rate per horsepower hour, including auxiliaries as developed during numerous dynamometer car tests on various individual locomotives of this class, show an average of 2.8 lb. of coal per dynamometer horsepower hour with a minimum of 2.7 and a maximum of 2.9.

We took one of these locomotives, bored the cylinders out from 29 in. to 29½ in. diameter and over a total period of 1 hr. 42 min. produced an average sustained indicated horsepower in the cylinders of approximately 5,400 and a maximum indicated horsepower of 5,855 at 33 m. p. h., 55 per cent cut-off.

Chicago & North Western System.—Have not built any new locomotives since previous reports. Have, however, increased the steam pressure on four 4-6-2 heavy passenger locomotives from 210 lb. to 225 lb., at the time we increased the diameter of the driving wheels from 75 in. to 79 in. to operate them on our train "400" between Chicago and the Twin Cities. We have twelve 4-6-2 locomotives in this class and are arranging to raise the steam pressure of the remaining eight from 210 lb. to 225 lb., and use them on our heavier high-speed trains.

We are very much in favor of higher steam pressures and believe that considerable economy can be effected by using same, also that satisfactory service can be obtained without any more maintenance expense than for the lower steam pressure formerly used.

Delaware, Lackawanna & Western.—In 1934 had built at Schenectady for passenger and fast-freight service twenty 4-8-4 type locomotives, Nos. 1631 to 1650.*

Missouri Pacific.—For the past five years we have had 25 locomotives of the 2-8-4 type, which carry 230 lb. pressure and ten 4-8-2 that carry 250 lb. pressure. There is an advantage in carrying a higher pressure as in order to get the power, diameter of the cylinders may be reduced. There is also a little saving account of this higher pressure, but the amount is negligible. So far we have had no trouble with these boilers as far as excessive maintenance is concerned. These locomotives have been in service for five years.

Lehigh Valley.—Since the last report have received and placed in service five 4-8-4 type locomotives.* These boilers are built, with exception of the syphon and smokebox sheet, of nickel steel. This is the same steel that we had in the previous 22 locomotives, some of which in 2½ years of service have made approximately 275,000 miles and no indication of any boiler trouble whatever, with exception of one boiler in which, after it had been in service a short time, we found laminations in one of the side sheets of the firebox. This portion of the sheet was replaced and since then no further trouble has been experienced. The fireboxes and combustion chamber have welded seams. Upon inspection of these boilers we have found practically no failures of staybolts since the locomotives were placed in service.

New York Central Lines.—In connection with report made in 1934, concerning 4-6-4 type locomotives operating at 225 lb. steam pressure with nickel-steel shell course, placed in service in 1932, it should be noted that three of these locomotives are so equipped instead of two. There is nothing particularly to add in this connection to what was said in the 1934 report. No defects have developed in any of the nickel-steel plates to date.

Norfolk and Western.—Advises that they raised the pressure from 240 to 270 lb. on a group of ninety 2-8-8-2 mallet locomotives, part of which were U. S. R. A. engines, the others being practically duplicates, 270 lb. being the limit which the boiler shells would carry; however, it was necessary to make some reinforcement in the bracing. This change increased the tractive force from 101,470 to 114,154 lb., and reduced the factor of adhesion from 4.72 to 4.19.

In the construction of a group of twenty 2-8-8-2 mallet locomotives, which are slightly heavier, but in general identical with the other 90, the boilers were designed to carry 300 lb. per sq. in. pressure, developing a tractive force of 126,838 lb., with factor of adhesion 4.13, using the same cylinder sizes as are used on the other group of ninety, due to roadway space limitations. Thus, with the 300 lb. pressure we are able to develop the full adhesion force of the engine. So far we have not had any experience to indicate any disadvantage with this pressure. It was thought that possibly difficulties of lubrication would increase with the temperature and pressure; however, the changes in temperature with the pressure increase has not been great enough to make any noticeable difference in our lubrication problems.

In general, it might be said that the high pressure does not result in an increase in thermal efficiency for the reason that our present valve mechanism does not permit satisfactory and efficient use of short enough cut-off to utilize the full expansive value of the high-pressure steam. This would be particularly true with simple engines. Our mallets are compound and we are able to use the expansive value of the steam to a greater degree than would be practicable with the simple engine.

American Locomotive Company.—We have, since 1920, built about 500 locomotives with staybolted fireboxes designed for boiler pressures of from 240 to 300 lb. inclusive; about 150 of these boilers had high-tensile boiler plate and about 50, high-tensile firebox plates.

The service reports received from the railroads operating these engines seem to indicate little difference in the performance obtained as between plain carbon and alloy steel for boiler construction, both indicating little, if any, difficulty chargeable to the increase in working pressure; we have stepped up the pressures gradually, and since the stresses are taken care of in the design, no serious trouble should be anticipated. Naturally, the high-tensile boiler plates do save considerable weight wherever used.

With regard to the use of alloy steel on the "other parts" affected by working pressure, these would include rods and motion work, crank pins and axles; as far as our experience goes, there has been no great change in the use of alloy steel for these parts in the past few years. The general trend seems to be toward plain O.H. carbon steel for crank pins and axles, but in many cases using alloy steel for rods and motion work; this seems logical, as there is little saving in the size of crank pins and axles, which must be designed for bearing pressure as well as fibre stress, while the rods and motion work may be lightened to advantage through the use of alloy steel.

Summary

Disadvantages,—increase in failures of firebox staybolts, firebox sheets, higher material cost, and increased weight of boiler when limited to the usual tried material.

Steam economy may be obtained in single-expansion locomotives by increase of expansion ratio, which involves along with higher steam pressure and temperature a short cutoff and later release, using independent admission and exhaust valves, thereby giving quick flow and volume to the initial steam action and controlled compression.

* See *Railway Mechanical Engineer*, January, 1935, for particulars concerning these locomotives.

* These locomotives were described in the *Railway Mechanical Engineer*, April, 1935.

With higher steam pressure a smaller diameter of cylinder with longer stroke can be used for power requirements, in which case, larger diameter driving wheels, lighter counterbalance and smoother running locomotive, and a smaller steam consumption are possible.

The use of water-tube firebox with higher boiler pressure effects maintenance economy in that staybolt failures and labor of testing them is no longer troublesome, and there is no increase in terminal delay due to boiler-washing period as double crew can be employed by working, one on each side of the firebox.

Sidewall insulation on firebox can be run from shopping to shopping, needing only occasional plastering of the joints which contact with the tube and door-sheet joint.

Nickel-steel fireboxes are reported by a limited number of roads as giving no trouble and where used in shells no difficulties are experienced. Use of high-tensile silicon-steel sheets allowing the application of thinner sheets of reduced weight has developed no trouble.

One road applying steel staybolts in water space on 40 locomotives in 1930 reports to date no trouble experienced.

One road reports that as their high-pressure boilers become older, all the advantages of higher boiler pressure have been maintained and maintenance of the alloy-steel boilers has been relatively less than for the lower-pressure carbon-steel boilers.

It has been suggested that from the standpoint of locomotive efficiency and economy, the railroads will have to follow the established practice of central power stations and steamships in using higher steam pressures.

As applying to steam locomotives, with the present state of the metallurgical art and from the standpoint of the utilization of the present heat in the steam, it is thought that 500 lb. pressure and about 750 deg. F. total temperature should be an established limit as compared with from 1,200 to 1,400 lb. and from 800 to 900 deg. F. as limits for central power station operation, all of which has presented no unusual problems.

Roller Bearings

Replies to questionnaire dated May 31, 1934, were submitted by 81 roads; 25 roads reported applications and furnished data for the period June 1, 1934 to December 1, 1934, 56 roads reported no applications of roller bearings to locomotives and tenders. Five roads which submitted data for previous analysis did not resubmit data in connection with the present study.

[Accompanying tabulations which covered replies from seven roads, showed type of bearing, location of installation and information as to service results.—EDITOR.]

In commenting on the application of roller bearings to rods, one road advanced the following information: "Crank-pin bearings and their special rods and crank pins are still in the early development stage and require care in the back shop and enginehouse beyond that ordinarily required for lateral adjustments and friction bearings. Precision fitting and extremely careful lubrication are required to maintain these pins and bearings, crosshead-pin bearings and special materials and construction details which go with them, and have been the most difficult problem in the application of roller bearings."

Another road advanced the following information: "About a year since we applied roller bearings to the main pins of a passenger locomotive (back end of main rods and main section of side rods). This locomotive is a Pacific type having weight on drivers of 192,500 lb., a tractive force of 42,750 lb., 24 in. by 28 in. cylinders and 225 lb. boiler pressure. It has now approximately 100,000 miles of service, which has been so satisfactory that arrangements are being made to apply a second set with the addition that the roller bearings will also be used on the eccentric-crank arms."

Perhaps the main problem connected with roller-bearing application has been in connection with broken and failed axles, due to stress concentrations that have not been fully understood. Several roads have subjected their axle designs to photo-elastic studies, disclosing serious localized stress conditions which were undoubtedly the cause of the failures and have thus been able to redesign axles and introduce stress-relief grooves in hubs, with beneficial results. The photo-elastic method has even a wider application in study of stresses in various locomotive parts.

Driving and Trailer Tires

This subcommittee has been augmented by two members of the Specifications Committee and is cooperating with the Technical Committee of the Tire Manufacturers Association.

A questionnaire was sent out early in 1934 requesting detailed reports of tire failures on steam and electric locomotives for a period June 1 to December 1, 1934. This information was tabulated and important information analyzed by the joint committee. It was found that a wide variation existed in description of tire failures and in explanations as submitted. It has therefore been difficult to clarify the causes of the tire failures reported. Many reports were not clear as to whether the tire actually ruptured in service or whether it was removed on account of finding cracks. There is also a great difference of opinion as to the reporting of shelled treads and as to cracks developing from the bore, some roads apparently attributing these defects to faulty material, whereas a careful analysis in many cases would develop that improper machining and mounting—leaving ragged tool cuts—caused the starting of cracks which developed in the bore.

It was therefore felt that while the information collected was of value, more detailed instructions should be prepared for the tabulation of tire failures in response to the questionnaire issued covering the period December 1, 1934 to June 1, 1935. The committee has therefore classified the types of failures in order that the roads can definitely report tire failures under one of these headings. This classification as proposed by the committee is as follows:

CLASSIFICATION OF TIRE FAILURES

Report should be made of all tire failures comprising a complete rupture of the tire, or a defect sufficiently serious to require the removal of the tire from service, either on account of safety or for the purpose of a more detailed investigation.

A study of the tire failures which have been submitted indicates that the failures can be classified under the following types: Reference is made to figures which will be found in the Wheel and Axle Manual, Revised Feb., 1935.

1—Thermal Cracks—These cracks, or checks, develop in the tread or flange at right angles to the plane of the tire—see figures 40, 41, 42 and 43. Defects so reported are variously described and include the following: Brake burns, and structural transformation due to heat.

2—Shelled Tread—Shelling consists of a break-down, or flaking, or spalling of the tread—see figures 31, 32, 33, 34 and 35. Shelling may extend completely around the circumference of the tread and may penetrate to a considerable depth. If the defect cannot be removed by a cut ½ in. deep it should be classified as "deep shelled," and be so reported. See figures 38 and 39.

3—Cracks in Bore—Cracks originating at the surface of the bore due to mechanical causes are variously described and include the following progressive fractures originating in any part of the bore, lip, groove, rivet or bolt holes: Tears in bore by machining; improper fit surfaces, such as taper, convex or concave bore of tire or outside diameter of wheel center; rim pockets in wheel center; caps between shims or overlapping shims; wheel centers out of round; corrosion of bore; excessive shrinkage.

4—Welding or Torch Burns—These defects may be due to burning by arc contacting or by gas torch.

5—Shattered—A shattered condition develops when a portion of flange or rim parts from the remainder of the tire and shows on parting smooth surfaces of any considerable area. This parting usually develops in a circumferential direction. See figures 20, 21, 22 and 23.

6—Gas Pocket—A void or discontinuity of metal in the section of tire, which may or may not be apparent on the surface.

7—Segregation, or Improper Chemical Composition—This condition should only be reported when verified by laboratory investigation.

8—Cause Unknown—Searching investigation should be made of each failure to determine, if possible, the correct cause and classification to avoid as far as possible reporting the cause as unknown.

Reports furnished were reviewed from several standpoints in the effort to ascertain if the majority of failures could be attributed to chemical content of the steel, to practices in manufacture, to road limits followed, to the location on the locomotive of the tire which failed, or to the year or time of year in which the tire was manufactured. This information has been tabulated and reviewed, but it is felt that in this analysis again, so much difference of opinion exists as to causes that the committee should await the reports of the next six-months period before drawing any conclusions with respect to these items and making more detailed reports.

The committee wishes to impress upon railroads reporting tire failures that the information as submitted has been of much value and that it is of great importance to the roads, as well as the tire manufacturers, that the committee should be continued and that further reports should be made covering tire failures which occur in the period June 1, 1935 to December 1, 1935.

Code of Rules to Govern the Movement and Handling of Locomotives Which Fail on the Road Due to Broken Parts

I—TYPES OF FAILURES

Due to the considerable number of parts of a locomotive which are subject to failure on the road and the rarity with which the failure is the same in any two instances, and because of the important influence of attendant circumstances, such as nearness to terminal, availability of other power, importance of train being handled, condition of other traffic, and location of failure with respect to clearance of other trains, it is difficult to state the exact procedure to be followed in each case. However, failures on the road due to broken locomotive parts may be classified into three distinct groups so far as the final handling of the locomotive is concerned, and without respect to the influence of attendant circumstances mentioned above. These groups are as follows:

Group 1—Failures which necessitate towing of locomotive to terminal.
Group 2—Failures of such a nature that it is possible to take the locomotive, only, to the terminal under its own steam.
Group 3—Failures of such a nature that it is possible to proceed with train under own power at reduced speed and under special orders.

Of the above, failures which are classified in Group 3 will create the widest range of possibilities as to final handling.

II—Classification of Failures as Determined by Part of Locomotive Which Has Broken or Failed on the Road

In order to decide quickly what action to take in event of a locomotive failure on the road due to a broken or failed part, the more important items comprising each of the three general classes of failures are listed below:

Group 1—Typical examples of locomotive parts which may break or fail on the road and cause a failure which must be classed in this group are as follows:

a—Broken driving tire.
b—Air-pump failure, or failure of air-brake equipment sufficient to prohibit positive control of the locomotive by air brakes.
c—Any one of the following: Broken axle, broken crank pin, broken main rod, broken side rod, broken piston rod.
d—Stripped valve gear on both sides, or failure of such a nature as to require blocking of both piston valves.
e—Failure of such a nature as to require dumping of fire. (In this group are arch-tube and syphon failures, blown-out washout plugs, blow-off cocks stuck open, failure of any cab fitting which causes an excessive amount of steam in the cab and which cannot be repaired on the spot, failure of grate center frame.)

Group 2—Comprising this group are the following typical examples:

a—Broken eccentric crank or portions of valve motion which require blocking piston valve on one side only.
b—Broken grate bar.
c—Extensive failure of spring rigging.

Group 3—Classification of an engine failure in this group is determined by the following:

a—Failure of feedwater heater equipment, resulting in the use of an injector which is of insufficient capacity to supply the demands of the boiler when operating engine at capacities necessary to maintain schedule.
b—Failure of stoker, making it necessary to fire locomotive by hand. With most modern locomotives it is practically impossible to maintain train schedules when necessary to fire by hand.
c—Broken engine spring.
d—Failure of automatic train control or automatic cab signal, necessitating movement under special orders.

Decision as to the proper procedure with engine failures falling under Group 3 rests with the engine crew in the absence of road supervision or divisional officers. Such factors as nearness to a terminal, availability of other power, and the importance of the train being handled must be given due consideration. The engine crew may communicate with superior officers in making their decision as to whether to proceed with the train or not, and, in the event it is decided to proceed with train, special orders should be obtained from chief dispatcher.

III—Moving of Failed Locomotives

Having classified the engine failure into the proper group, thereby determining the procedure to be followed, there are certain special considerations to be given to the movement of the failed locomotive if the failure is classed in Group 1 or 2.

In the event of a failure in Group 1, necessitating towing the engine to a terminal, special care should be taken before moving the engine to see that every precaution has been taken to prevent doing further damage to the engine. Where a driving tire has broken, it is necessary to block the wheel and spring rigging and cut out the brake rigging on that wheel. Likewise, with an axle failure, the load and brake rigging should be removed from that pair of wheels. The wheels and broken axle should be removed entirely if the nature of the break makes this necessary. When a side rod has broken, the corresponding rod on the opposite side should be removed to prevent buckling of rod or shearing of crank pin.

While still on the main line with the train, only such work should be done to the engine as to permit moving it off the right-of-way, or into the proper position in the train, in the event it is to be towed to the terminal with the train it gave up. In this case the crippled engine should be located in the train in accordance with local requirements concerning concentration of loads on bridges.

When towing a crippled engine the speed should be governed by the nature of the failure which has occurred, special attention being given to control the speed in moving an engine from which some of the rods have been removed.

When moving a failed engine to the terminal under its own power, as called for in Group 2, the speed should be held down to a safe limit to prevent further damage to the engine. Where the failure is due to a broken grate bar, it will probably be possible to maintain steam for running the light engine, providing it is run slowly.

Where it is decided to continue on with the train, in the case of an engine having failed from some of the causes listed in Group 3, the movement of the engine will be governed by existing circumstances. It is imperative that speed be reduced in the event of a broken driving spring, which has been blocked and with which it has been considered safe to proceed.

Code of Rules to Govern the Preparation of Locomotives for Storage in Good Order and Care of Such Locomotives in Storage

I—Preparation of Locomotive for Storage

In preparing a locomotive in good order for storage, consideration should be given to the following circumstances which will influence the amount of time and expense to be spent in such preparation: Length of time locomotive will be stored; season of year; age and value of locomotive; location in which locomotive will be stored (in doors or out of doors).

The procedure outlined herein governs the preparation of locomotives in good order for storage for an indefinite period in the open. A schedule of the work to be performed is as follows:

a—Boiler, Firebox and Accessories:
1—Wash boiler.
2—Apply anti-corrosive preparation to interior of boiler. (Method to be used will be governed by nature of anti-corrosive used.)
3—Reapply washout plugs or insert screens in their place.
4—Cover or remove safety valves. (If safety valves are removed, holes should be plugged or capped.)
5—Thoroughly clean flues, firebox, smokebox and ashpan.
6—Pass forceful stream of air through superheater units to remove moisture.
7—Cover top of smoke stack with adequate cover securely fastened.

b—Piping, Air Reservoirs, etc.:
1—Blow out all piping that may contain water.
2—Drain air reservoirs.
3—Break joints, or drain by removing cocks or plugs, all steam, water and air pockets.
4—Remove gage syphons.

c—Running Gear:
1—After cleaning thoroughly, coat main and side rods, valve-gear parts, guides, piston rods, and all other outside finished parts with a mixture of white lead and oil or an anti-corrosive compound.
2—Apply coat of oil to walls of main cylinders and valve chambers.

d—Jacket and Smokebox:
Examine jacket and smokebox and apply a coat of oil or some other rust resisting compound if it is apparent these surfaces need protection.

e—Special Appliances:
1—Oil and grease air compressors, feedwater pump, stoker engine, and any other special devices. Operate these appliances with air for a short time to distribute lubrication over cylinder walls and other exposed surfaces.
2—Remove or board up generator and headlight.

f—Cab:
1—Board up rear of cab or drop and fasten back cab curtain.
2—Close and board up cab windows.

g—Tender:
1—Remove coal from tender coal space and stoker trough, and water from tank cistern.
2—Paint interior of coal space.
3—Spray interior of tank cistern and swash plates with soda ash.

h—Tools:
Remove and place in storeroom all tools, air hose, chains, or any attachments subject to easy pilferage.

II—Care of Locomotive in Storage

a—Inspection:
1—Examine stored locomotives regularly for signs of rust or other deterioration and take corrective measures, if necessary.
2—Locomotives in storage should be moved occasionally to permit examination of hidden parts.

b—Removal of Parts of Stored Locomotives for Use in Repairing Other Locomotives:
This is a practice which should be prohibited, and any evidence that parts have been removed from a stored locomotive should be reported at once to proper officials.

Code of Rules to Govern The Firing Up of Locomotives

This code has been prepared to cover the procedure to be followed in the firing up of locomotives.

I—Filling of Boiler

In filling the boiler it is preferable that hot water be used, care being taken to start with water at approximately the same temperature as that of the boiler shell, gradually increasing the temperature to the maximum. The boiler should be filled until at least one full gage shows in the water glass. While filling the boiler, gage cocks, water glass, and water column valves should be checked to see that they are functioning correctly.

In direct steaming, a mixture of steam and hot water should be injected into the boiler until the water shows at least one full gage in the water glass. Water is then cut off while steam is continued until the desired pressure is reached. This pressure may be maintained by further injection of steam periodically until ready to start fire.

II—Inspection of Locomotive

Having filled the boiler, and before lighting the fire, a thorough inspection of the locomotive should be made with respect to the following items:

a—The tank cistern should contain a sufficient supply of water to take care of firing up and moving to water spout.
b—Boiler, boiler attachments and firebox should be examined to see that they are in good condition.
c—The main throttle valve should be closed and reverse lever placed in central position.
d—Driving wheels should be blocked to prevent creeping in the event of a leaky main throttle.
e—Cylinder relief valves should be open.

III—Building of Fire

a—Coal Burning Locomotives.—Before laying the fire, the house blower should be connected and opened slightly. In building the fire, the grates should be completely and uniformly covered with a layer of coal of sufficient depth to prevent excessive or unequally distributed quantities of air entering the firebox. A layer of oil-saturated shavings or its equivalent should be distributed over the coal, after which the fire may be ignited. The house blower may be turned on with greater force as coal begins to ignite. In order to prevent excessive smoke, jets of air or steam may be admitted to the firebox. As required, additional coal should be added in small quantities with a shovel.

b—Oil Burning Locomotives.—When firing with oil, remove carbon or any obstruction between the flash wall and burner. The blower valve should be opened sufficiently to expel all explosive gases from the firebox before starting the fire. Place the fire lighter in the firebox and open atomizer sufficiently to carry oil to the lighter. The fire should not be lighted by splashing oil on hot bricks. After oil is ignited, the atomizer should be regulated so that all oil is completely burned.

c—Direct Steaming.—In direct steaming the fire should be prepared as previously outlined and lighted a short time before the engine is dispatched.

IV—Raising of Boiler Pressure

A very important detail to be observed in firing up a locomotive is the amount of time to be consumed in raising the pressure to the normal working pressure. This should be from one and one-half to three hours, depending upon the size of the locomotive. Forcing the fire and raising boiler pressure too rapidly when firing-up results in high boiler maintenance.

Exhaust Steam Injectors and Feedwater Heaters

Thirty-six roads were canvassed to develop the number of additional exhaust-steam injector and feedwater heater applications contemplated during 1935 on existing locomotives. Thirty roads reported no applications contemplated during 1935. Six roads advised programs in effect which total 91 applications divided into 81 feedwater heaters and 10 exhaust-steam injectors.

Manufacturers were also contacted to obtain information in regard to improvements in their equipments but the information furnished was meagre, however, additional applications for 1933 and 1934 were reported as follows:

Manufacturer	1933	1934
Worthington Corporation	23	66
Wilson Engineering Company	6	15
Wm. Sellers & Company (Exhaust steam injectors)	..	5
Superheater Co.	Not furnished	
J. S. Coffin	Not furnished	

Although efforts were made to ascertain the total number of locomotives equipped to date with the various types of feedwater heaters and exhaust-steam injectors, the information furnished is not complete.

The feedwater heater has become an acknowledged necessity on modern locomotives from the standpoint of fuel economy, water saving and improved service. Manufacturers have been aware of the necessity for improving their products and feedwater heaters may now be regarded as standard equipment the same as the superheater. During the past several years the various types of heaters and exhaust-steam injectors have undergone improvements in design and application which are reflected in lower maintenance and more reliable performance. Considering the established status of the feedwater heater, the committee will hereafter confine its investigation and reports to the exhaust-steam injector.

Oil-Electric Locomotives

Your committee on subject of "Development and Use of Oil Electric Locomotives" obtained statistics for 1934, covering the individual oil-electrics placed in service, but did not secure operating costs per hour as, due to location, service hours per day, and manner of reporting, these are not definitely established.

A review of statistics is conclusive that the 600-hp. Diesel locomotive is the most favorable at present, and while the 300-hp. Diesel locomotive unit is noted at 55.87 per cent of the total, at least one-half of these locomotives are three-power units with internal power developed by 300-hp. oil-engine set.

It is noticeable that present trend is toward greater capacity and 800-, 900-, and 1,200-hp. Diesel locomotives may be assigned for test in yard switching service. Furthermore, units of 1,800 hp. and 2,000 hp. are under construction for assignment to road service and passenger-train service in either single or articulated units, from which total horsepower development can be obtained to haul the heavier freight and passenger trains at prevailing speeds.

This development will be watched and with improvements in design and construction and attending stand-by losses with oil electric locomotives, it may show economic operation, and with satisfactory operating conditions and conservative maintenance costs, will invite attention for further consideration.

Failed Parts of Locomotives

[A sub-committee has made a study of the methods used for reporting, analyzing and correcting the failures of locomotive parts. Sample report blanks and record cards were submitted and suggestions made as to their use.—Editor.]

Locomotive Weight Distribution

[The report of the Committee on Locomotive Construction closed with a very complete description of the methods to be used for determining the distribution of locomotive weight on the different axles and also the methods used to calculate the center of gravity. This portion of the report was prepared by the engineers of the three locomotive builders. On account of its completeness and importance it will be printed as a separate article in a later issue.—Editor.]

The full report was signed by W. I. Cantley, (chairman), mechanical engineer, L. V.; H. H. Lanning (vice-chairman), mechanical engineer, A., T. & S. F.; R. G. Bennett, general superintendent motive power, Penna.; G. McCormick, general superintendent motive power, So. Pac.; W. F. Connal, mechanical engineer, Can. Nat.; G. H. Emerson, chief motive power and equipment, B. & O.; A. H. Fetters, general mechanical engineer, U. P.; J. E. Ennis, engineer assistant, N. Y. C.; S. S. Riegel, mechanical engineer, D., L. & W.; D. S. Ellis, engineer motive power, C. & O., and C. Harter, chief mechanical engineer, Mo. Pac.

Discussion

J. W. Burnett, general superintendent of motive power and machinery of the Union Pacific, stated that he was finding it advisable to replace brass sleeves between safety valve bases and the boiler with steel sleeves and asked if the committee would be willing to change its recommendation by omitting reference to brass as the material to be used in the sleeves. H. H. Lanning, mechanical engineer, Atchison, Topeka & Santa Fe, chairman of the sub-committee, said that the committee would take this under consideration. In answer to a question he also said that it was not the intention of the committee to have anything to do with the interior parts of safety valves but to confine itself to the consideration of requisites and attachments.

Mr. Burnett also questioned the desirability of establishing a standard code of rules governing the handling of locomotives which fail on the road. These are situations, he said, which must be dealt with according to circumstances and he felt that any code of rules issued by the division might be misunderstood. D. S. Ellis, engineer of motive power, Chesapeake & Ohio, the sub-committee chairman, said that it was not the intention of the committee to establish a standard code but that it had brought together the best provisions of such rules as were in effect on roads having codes of their own into a code which might serve as a model to assist other roads, some of which had specifically requested that they be given such help.

Action.—The report was accepted.

Brakes and Brake Equipment

Air-Brake Piping

Prior to 1929 the air-brake piping for freight cars in general use was single-weight pipe. During that year extra heavy pipe, except nipples at angle cocks, was adopted as recommended practice. We recommend advancing to standard, the present recommended practice for air-brake piping on freight cars.

Welding Brake Beams

Rule 23, Section 4, permits welding cracks or fractures in brake beams, while the same rule, Section 3, permits welding only parts under compression in brake-beam heads. We believe Section 4 permits too much latitude in the repairs to brake beams, and may result in attempts to weld cracks and fractures in compression members, tension members and struts. Compression and tension members having cracks or fractures involving 40 per cent of the area of these parts, should be renewed instead of welded. We recommend elimination of this item from Rule 23.

Geared Hand Brakes

A joint committee of the Safety Appliance, Car Construction and Brake Committee have formulated proposed specifications for geared hand brakes in accordance with the reasons set forth in the report of the Car Construction Committee.

During recent months this study, which includes geared hand brakes of the vertical-wheel, horizontal-wheel and lever types, has been proceeded with and tentative specifications jointly agreed upon and concurred with in principle by the Director of the Bureau of Safety, I. C. C., with whom your representatives have consulted on this question. Subsequently, conferences were held with the various manufacturers and the matter brought to the following conclusion:

For application to new freight cars, or for new installations to existing freight cars, this committee recommends for adoption as standard, proposed specifications for geared hand brakes as follows, and also recommends inclusion in the Interchange Rules of the following requirements in the event favorable action is taken in connection with this recommendation:

Geared hand brakes applied to cars built new on or after January 1, 1936, must comply with the requirements of the A. A. R. specifications.
All new installations of hand brakes made on or after January 1, 1936, must comply with the requirements of the A. A. R. specifications.

Proposed Specifications for Geared Hand Brakes

Vertical Wheel Brake

1—Hand brake shall operate in harmony with power brake and the design shall be such that force will be applied to the brake-cylinder lever at the brake piston connection throughout a lever movement of not less than 14 in. When brake piston is in fully released position, there shall be no excess slack in the hand-brake chain or other connections and provision shall be made in the design for winding chain uniformly on drum without overlapping.

2—Overall diameter of hand-brake wheel to be nominally 22 in. with a leverage ratio between rim of hand brake wheel and brake piston connection of not less than 32 to 1 and not more than 50 to 1. The effective force exerted at air-brake piston connection must be not less than the force exerted by the air-brake cylinder at 50 lb. pressure based on single capacity brakes. Hand-brake leverage ratio selected must provide braking power of not less than 20 per cent of total weight of car and nominal capacity based on a force of 125 lb. at rim of wheel.

3—Depth of wheel hub to be 2⅝ in. with square taper fit on shaft, taper 2 in. in 12 in.; outside end of shaft to be 1 15/16 in. square. Wheel to be secured to shaft with not less than ¾-in. standard nut with lock nut or cotter or end of shaft riveted over.

4—Hand wheel to be designed so as to prevent trainmen from reaching through between spokes to operate ratchet lever. Openings to be of sufficient depth, preferably 3½ in. and not to exceed 4 in., to provide proper grip on rim with gloved hand.

5—Overall depth of complete unit (outside face of hand wheel to bolting face of housing), not to exceed 10¾ in. Clearance between rim of wheel and any part of housing or car not less than 4½ in.

6—Hole spacing for attachment of housing to car to be made 11¼ in. horizontal and 12 in. vertical. On box and other house cars, vertical-wheel brake shall be so located that top of rim of hand wheel is not below edge of roof, or above level of longitudinal running board.

7—Ratchet operating lever, where used, is to be arranged to travel in vertical plane and to throw to *left* facing hand brake when in applied position and to the *right* for release. Operating lever should preferably be horizontal but in all cases within 45 deg. of horizontal when in applied position. Movement of lever to be limited insofar as practicable but, when in release position, should be sufficiently off vertical center to automatically release the pawl from ratchet wheel when the brake wheel is moved in direction of application sufficiently to release the pawl of entire load. Positive connection is to be provided between the operating lever and pawl so that the pawl may be forced to application position by hand when necessary.

8—Brake wheel and drum shall be arranged so that both will revolve when applying and gradually releasing the hand brake.

9—Where quick release feature is used instead of ratchet and pawl arrangement and operating independently of the brake pawl, it shall be arranged to operate so that hand wheel will not revolve in counter-clockwise direction when brake is released by this means.

10—A. A. R. Standard 9/16-in. hand-brake chain or minimum ¾ in. diameter rod to be used.

11—Any efficient means for transferring vertical pull to horizontal at end sill may be used. Where sheave wheel is used, this must be not less than 4 in. diameter.

Horizontal-Wheel Brake

1—The hand brake shall operate in harmony with the power brake and the design shall be such that force will be applied to the brake-cylinder lever at the brake-piston connection throughout a lever movement of not less than 14 in. When brake piston is in fully released position, there shall be no excess slack in the hand-brake chain or other connections and provision shall be made in the design for winding chain uniformly on the drum without over-lapping.

2—Overall diameter of hand-brake wheel to be nominally 16 in. with a leverage ratio between rim of hand-brake wheel and brake-piston connection of not less than 32 to 1, and not more than 50 to 1. The effective force exerted at air-brake piston connection must be not less than the force exerted by the air-brake cylinder at 50 lb. pressure based on single-capacity brakes. Hand-brake leverage ratio selected, based on lever arm equaling the hand-brake wheel diameter, must provide braking power of not less than 20 per cent of total weight of car and nominal capacity based on a force of 125 lb. at rim of wheel.

3—Brake pawl and ratchet lever must be so located that the former may be moved to application or release position with either the foot or hand. When ratchet lever or weight is used to operate pawl located on roof or brake step, it must be arranged so that it can be operated with either the foot or hand.

4—Ratchet operating levers applied to housings of hand brake equipped with power multiplying devices must be arranged to travel in a vertical plane and throw to *left*, facing hand brake when in applied position and to the *right* for release. Operating lever should preferably be horizontal but in all cases within 45 deg. of horizontal when in applied position. When in release position, it should be sufficiently off vertical center to release the pawl automatically from ratchet wheel when the brake wheel is moved in direction of application sufficiently to release the pawl of entire load.

5—Brake wheel and drum shall be arranged so that both will revolve when applying and gradually releasing the hand brake.

6—Where quick release feature is used instead of ratchet and pawl arrangement and operating independently of the brake pawl, it shall be arranged to operate so that hand wheel will not revolve with drum when brake is released by this means.

7—When multiplying devices are used to multiply the forces between the hand-brake wheel and brake shaft to which it is directly attached, A. A. R. Standard 9/16-in. hand-brake chain or minimum ¾ in. diameter rod must be used.

8—Any efficient means for transferring vertical pull to horizontal at end sill may be used. Where sheave wheel is used this must be not less than 4 in. diameter.

Lever Brake

1—Hand brake shall operate in harmony with the power brake and the design shall be such that force will be applied to the brake-cylinder lever at its brake-piston connection throughout a lever movement of not less than 14 in.

The hand-brake lever shall operate in a vertical plane, applying force to hand brake when lever is raised from vertical to horizontal position.

When brake piston is in fully released position, there shall be no excess slack in the hand-brake chain or other connections, and provision shall be made in the design for winding chain uniformly on the drum without overlapping.

2—Minimum length of hand-brake lever to be 14 in. with a leverage ratio between hand-brake lever and brake-piston connection of not less than 32 to 1 or more than 50 to 1. The

effective force exerted at air-brake piston connection must be not less than the force exerted by the air brake cylinder at 50 lb. pressure based on single-capacity brakes.

Hand-brake leverage ratio selected must provide braking power of not less than 20 per cent of total weight of car and nominal capacity based on a force of 125 lb. applied at a point 3 in. from outer end of hand-brake lever.

3—Overall depth of complete unit (outside face of lever to bolting face of housing or bracket) not to exceed 10¾ in. Minimum clearance of 4½ in. to be provided around hand-grip portion of lever in all positions.

4—Ratchet operating lever, where used, is to be arranged to travel in vertical plane and to throw to *left* facing hand brake when in applied position and to the *right* for release, and should preferably be horizontal but in all cases within 45 deg. of horizontal when in applied position. Movement of ratchet lever to be limited insofar as practicable but, when in release position, should be sufficiently off vertical center to automatically release the pawl from ratchet when the hand-brake lever is moved in direction of application sufficiently to release the pawl of entire load. Positive connection is to be provided between the operating lever and pawl so that the pawl may be forced to application position by hand when necessary.

5—Hand-brake lever and drum shall be arranged so that both will be directly connected when applying and gradually releasing the hand brake.

6—Where quick release feature is used instead of ratchet and pawl arrangement and operating independently of the brake pawl, it shall be arranged to operate so that hand lever will not move when brake is released by this means.

7—A. A. R. standard 9/16-in. hand-brake chain or minimum ¾ in. diameter brake rod to be used.

8—Any efficient means for transferring vertical pull to horizontal at end sill may be used. Where sheave wheel is used, this must be not less than 4 in. diameter.

General

Where necessary to design special geared hand-brake arrangement of any of the three types referred to above to meet conditions on cars of special construction, such designs and methods of application shall be referred to the Mechanical Division, Association of American Railroads, for approval.

Geared hand brakes of the vertical-wheel or lever-type must not be applied to the outer longitudinal side of any type of freight car; neither will they be applied to end of car in such a position as to require operator to stand on sill step or side ladder to operate brake.

Instructions for Operating Passenger Cars in Freight Trains

Owing to the increased number of refrigerator cars having passenger brake equipment, especially the U. C. brake, that are handled in freight trains, it has been suggested that consideration be given to the question as to whether it is advisable to cut out the emergency reservoir on cars having U. C. brakes, remove the protection valve spring and let out the piston travel on such cars when handled in freight trains. The subject was referred to a subcommittee which reports as follows:

The subcommittee discussed the foregoing at length with members of the engineering department of the Westinghouse Air Brake Company and conducted certain rack tests bearing on the subject.

The rack tests developed that when making a "straight away" emergency application with the U. C. valve, the brake system charged to 70 lb., and piston travel adjusted to 8 in., the auxiliary reservoir pressure dropped to 63 lb., this being the pressure against which the release has to be made after an emergency application.

When making a service application and pulling the brake-pipe pressure down to the point where automatic emergency occurred because of an over brake-pipe reduction, the auxiliary reservoir pressure was reduced to 50 lb.

The developed brake-cylinder pressure in both the "straight away" and automatic emergency test was 63 lb.

The effects of the higher auxiliary-reservoir pressure when releasing the U. C. brake in trains with freight-brake equipment prevails only in the case of a "straight away" emergency.

With facilities at hand, it could not be seen why the quick action valve should fail to close following an emergency application if the valve fit the cylinder properly, but as the test racks on which the laboratory test of the U. C. equipment were made represented passenger racks only, it was thought advisable to assemble a train of approximately 100 freight cars having K equipment and one or two cars having U. C. equipment for standing test, to determine primarily whether properly fitted protection valves in the U. C. valve will close following an emergency application.

The standing-train brake tests referred to were made at Trafford on the Pennsylvania, under the supervision of a member of the committee, with a baggage car having universal equipment located at rear end of a freight train in order to determine the probable operation of the protection valve of a U-12-B equipped refrigerator car in trains thus assembled. The results of these tests were:

There were 101 freight cars with K triple valves located ahead of a baggage car having the U-12-B universal valve. A high-pressure cap was used on the universal valve which had been modified so that the protection valve had the maximum allowable clearance in its bushing, i.e., .0125 in. on the diameter.

The train was charged through an M-3 feed valve set at 70 lb. The brake-pipe leakage as measured by the A. A. R. method was 4½ lb. and the universal valve on the rear end was found to charge to about 66 lb. The graduated release cap was set in direct release position. Several service applications and releases were made without any difficulty. We also made emergencies by allowing the brake-pipe pressure to get below the protection valve setting and in all cases the protection valve returned promptly to its atmospheric seat on restoration of brake-pipe pressure.

A heavy leak was created at the hose coupling at the rear end of the baggage car and the tests repeated. Brake pipe leakage by the A. A. R. method under this condition showed 5½ lb. Again there was no difficulty in getting the universal valve to release and the protection valve to seat properly.

The purpose of this test was to determine whether it would be necessary to remove the protection-valve spring. As a result of the tests it was concluded by those present that a universal valve in good condition would operate satisfactorily in a freight train without any change in the protection valve. There was no difficulty in getting the valve to release after a service application.

The conclusions of the subcommittee are:

1—Passenger cars having graduated-release feature must have this feature cut out for movement in freight trains.

2—Piston travel should be not less than 7 in., preferably 8 in.

3—That the time and labor involved in disconnecting emergency reservoir and plugging connections, or removing protection valve spring from U. C. equipment in cars to be handled in freight service and recoupling them upon return of the car to passenger service is not justified by service performance.

4—The water-raising system on a passenger car when handled in freight service should be cut out when conditions permit, and cutout cock is available in water system supply pipe."

Life-Period for Air Hose Renewals

This question was thoroughly discussed by the Air Brake Association in 1917 and 1918 and their recommendations at that time were not definite, although it appears that they considered 28 months as approximately the period air brake hose should be allowed to remain in service; notwithstanding the fact that 65 per cent of the failed hose inspected by their committee had given more than 28 months service.

In 1919 the question was referred to this committee, which, after thorough investigation, concluded that a review of the data available did not justify a definite recommendation as to a period during which hose should be arbitrarily removed, and in 1922 after further investigation, were still of the same opinion and suggested a revision of air-brake hose specifications to provide a better quality of hose under the direction of the committee on Specifications and Tests for Materials. Since that time the matter has rested until recently a member line has requested that some definite conclusion be set forth in connection with the inspection and life of air hose to prevent hose failures.

A subcommittee has gone into the question, having been in conference with some representative lines and finds that quite extensive investigations have been made on the subject, varying from 28,000 to 35,000 hose and in all reports seen, it is noted that the larger number of hose that failed were by no means the oldest hose. The opinion of your committee has not changed after this conference relative to the possibility of establishing a specified life for an air hose which will condemn it for further service. If hose are removed on this basis it would cause a large increase in consumption in proportion to the number of failures prevented, therefore, we believe that the most satisfactory results will be obtained from the proper education of the car inspector that he may use good judgment while inspecting air hose. This committee from personal observation in checking a large number of hose has found the same condition.

The series of photographs shown under Rule 56 of the A. A. R. Code of Rules, no doubt, furnishes a good education for the inspector. It is recognized that the judgment of inspectors will be found faulty at times if hose is placed on test rack, but under present specifications of the manufacturers and conditions which hose are subjected to, that is, undue strains account pulling hose

when uncoupling, storing of cars at which time hose deteriorate rapidly, the improper application of couplings and nipples, also position of angle cocks, which are important features in shops, proper education of inspectors is about all the recommendation that can be made at the present time. As a result of a conference with the Specification Committee they agreed that the subject would be taken up with the manufacturers and a further report may be forthcoming.

Wasp Excluders

This committee had brought to its attention about five years ago the question of providing a means of preventing wasps, mud bees or other insects from building nests in retaining valves, and closing the exhaust openings.

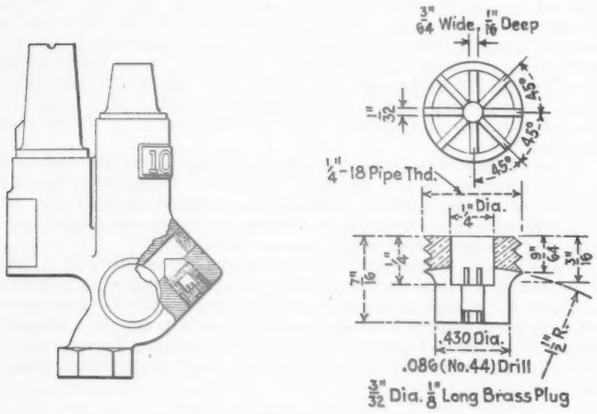


Fig. 1—Wasp excluder for retaining valves

Five years ago the air brake companies developed a brass plug equipped with slotted openings for application to the retaining-valve exhaust port to overcome the trouble. This plug was not entirely satisfactory. Subsequently they modified the design of

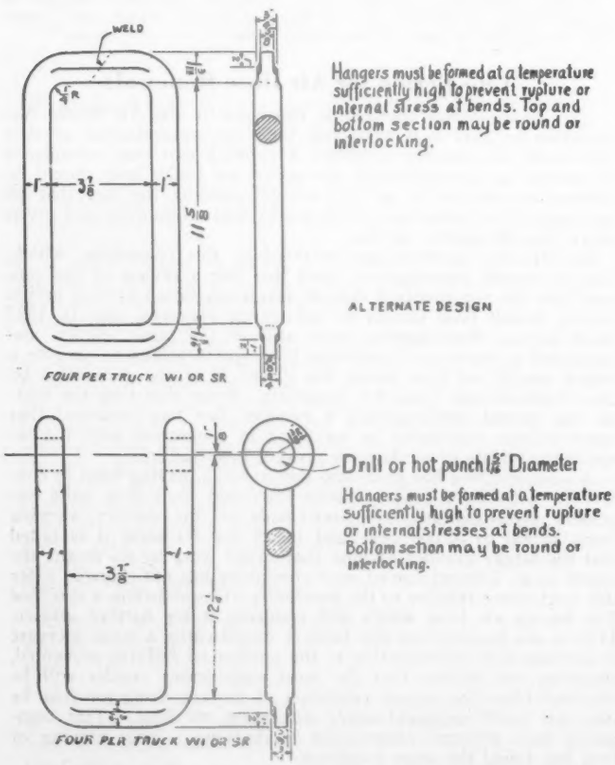


Fig. 2—Revised drawing of brake beam hangers

plug using narrower slots, and a number of this type were applied by several roads. They appeared satisfactory which led this committee to recommend them for adoption as recommended practice in order to provide for a more liberal application in service to determine if they justified adoption as standard.

During the past winter complaints have been received that the recommended-practice type adopted last year have given trouble due to ice and sleet freezing the openings on account of the device protruding outside the valve body. The troubles incident to wasps and mud bees entering the retaining valve exhaust opening and preventing a proper release of the brake is still serious enough to justify further development of a means to overcome this trouble.

We, therefore, recommend substituting as recommended practice the type of wasp excluder shown in Fig. 1 for that adopted last year.

Graduating Spring for Type K Triple

There has been some complaint regarding the proper tension of many new type graduating springs applied to K triple valve to reduce the tendency for undesired emergency.

Last year we recommended the use of a device (illustration omitted) for checking such springs before they were applied, the use of such device being optional.

In view of the apparent use of springs of improper capacity in many cases, we now recommend making the device for checking graduating springs, K triple valve, as shown in the Manual a standard part of the 3-T test rack.

Self-Locking Angle-Cock Handle

During the current year, the air brake manufacturers, in conjunction with representatives of the Committee on Brakes and Brake Equipment, have developed modifications in the locking feature of the self-locking angle cock which, in the judgment of the committee, will materially prolong the life of the handle and key socket of the locking-type angle cock.

The results to be anticipated with this improved construction are closer maintained alinement of the locking surfaces and the prevention of vibration and resultant wear when the car is in motion, thereby providing proper functioning of the device for long periods with minimum maintenance expense.

While there are no A. A. R. standard dimensions for the handle and socket key shown on the drawing (omitted from this abstract), and we see no reason why there should be at this time, the committee recommends their general use in purchasing new complete angle cocks and that where renewals of handles and keys are made, the improved design should be used.

Brake-Beam Hangers

Page E-6, Section E, of the Manual shows the loop and stirrup type brake-beam hangers commonly used on freight equipment as being ¾ in. by 1 3/16 in. top and bottom for the former and the same dimension for the bottom of the latter.

These hangers are formed from 1 in. round iron or steel and

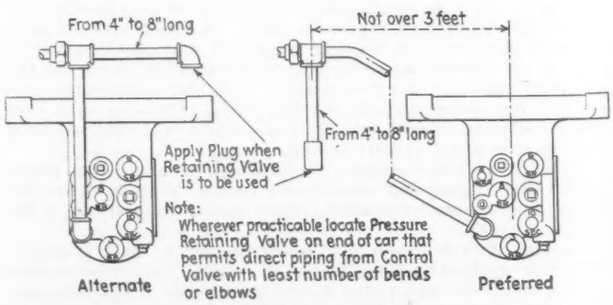


Fig. 3—Proposed retaining valve piping for passenger equipment cars

it is found there is not sufficient metal without upsetting at those points to provide for the dimensions shown.

We recommend substituting the drawing Fig. 2, for that now shown in order that it will be practical to make hangers to conform to the drawings covering same.

Retaining-Valve Piping for Passenger Cars

The Arbitration Committee has requested us to give consideration to developing means whereby the necessity for disconnecting and connecting retaining-valve pipe on passenger cars to meet requirements of the individual roads may be eliminated.

The Arbitration Committee has also requested that, in the event of inability to accomplish this, consideration should be given to providing a standard method of installing retaining-valve piping on passenger cars, so as to provide uniform loca-

tion of retaining-valve pipe fitting to be broken and disconnected in accordance with present practice and to minimize chances for disconnected pipe to become clogged with snow, etc.

At present there seems to be no standard location of union fitting in the retaining-valve pipe, which frequently results in loss of time in locating the fitting which is to be connected or disconnected, as may be required. Moreover, disconnected pipes as they are now arranged, have in many cases become plugged with snow, ice, etc., resulting in delays and stuck brakes.

The committee recommends that where retaining valves are applied to passenger cars, the pipe should be arranged in accordance with Fig. 3.

It will be noted that the drawing calls for a 4-in. to 8-in. branch in the pipe adjacent to the control valve, the pipe having a standard coupling which is at open end. To make retaining valve operative, it is only necessary to apply a pipe plug to the coupling in the branch. Where roads do not require the use of retainers and want the pipe disconnected, desired operation can be had by removing the plug from the branch outlet. Should the branch pipe become plugged at the coupling, no serious difficulty would result, therefrom, as release of the brakes can be had through the main pipe line and the retaining valve.

We believe that adoption of the proposed piping arrangement will accomplish the results desired by the Arbitration Committee, and it is so recommended.

Passenger Retaining Valve

Use of the graduated-release feature of the passenger brake on mountain grades is becoming quite prevalent, but there are at present several roads that are using retaining valves on passenger equipment cars in grade service and require that retaining valves and pipe be maintained in a serviceable condition.

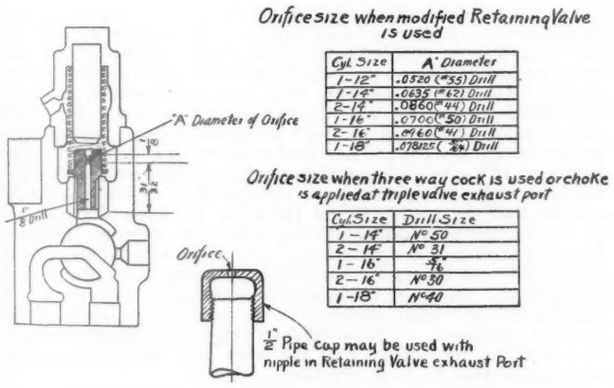


Fig. 4—Proposed modification in passenger car retaining valves

This committee has considered the subject, as we appreciate with improved passenger brake equipment and tight brake cylinders, the former method of using retainers is not entirely satisfactory and we believe a modification in retaining valves might be made to the end that trainmen would not be called upon to pass frequently through the train for the purpose of turning the valve up or down and also more satisfactorily to provide for adequate retainer control of head-end cars so constructed that the retaining valve cannot be conveniently reached.

In the early days when brake cylinders were subject to more or less leakage, it was desirable that a definite pressure value be provided for. However, with present tight cylinders and modern brake operating conditions with graduated-release feature, it is felt that a safe and quite flexible control of trains may be had through both light- and heavy-grade territory by a simple modification in the present retaining valve, i.e., drilling a fixed orifice through the closing valve of the retaining valve. By such modification the pressure may be completely released to avoid excessive speed or stalling where trains are passing through sags or on level sections of track or on adverse grade sections of a generally descending grade.

Some roads do not use passenger retaining valves on grades, but rely upon the graduated-release feature which is available in the LN, and UC equipments. The graduated-release feature affords an excellent means for controlling the train speed on grades but as the brake release in each cycle occurs at the normal fast rate, sufficient time is not always available to insure a complete recharge, and the charged pressure sometimes reduces as the brake cycles progress. This reduction of the charged pressure is undesirable because it necessitates speed reduction to provide for thorough recharging.

Tests of passenger trains have been made on grades of 2 to 3½ per cent by a subcommittee, and they have recommended a modification of the retaining valve to provide greater flexibility of train operation.

We recommend as standard practice the change in passenger retaining valves shown in Fig. 4 which illustrates the proposed modification of the retainer closing valve and a tabulated schedule of orifice sizes to be used in the retaining valves for various sizes of brake cylinders. The modification involves no new material and can easily be made in any shop at small expense.

Reworked Brake Beams

Due to complaints received as to failure of second-hand brake beams applied to foreign cars—many of such beams apparently being but slightly above the condemning limits when applied—a joint subcommittee, consisting of members of the Arbitration, Brake and Car Construction Committee, was appointed with request that specification be provided which would result in a reclaimed beam of reasonably satisfactory service life expectancy to car owner and eliminate many of the failures now being experienced as a result of second-hand brake-beam applications. This joint subcommittee has completed its report which will be submitted for letter ballot just as soon as approval of the various committees involved can be secured. Your committee has approved the report of the joint subcommittee.

Identification Mark for Brake-Shoe Key

This committee has been requested to suggest some form of marking the new standard A. A. R. brake shoe key in order to avoid confusion in billing where such keys are applied. Without some means of identification, inspectors and others have no means of identifying the new key and will either fail to make proper bills or render bills for the old standard key.

The marking shown on the brake shoe key (drawing omitted here) has been used by one road for some time and they have no difficulty in providing this marking. We would recommend revising the drawing on Page E-90 of the Manual to conform.

Brake Shoes

Supplementing the general report of the committee there was an additional report by a sub-committee on brake shoes. This supplementary report brought out clearly the pressing need for brake shoes of greater superiority and durability than the present standard plain chilled iron brake shoes with a reinforced steel back.

A check made of 41,830 freight-car brake shoes removed at 19 terminals on 9 representative roads showed that 22,262 shoes, or 53 per cent, had been removed on account of being broken and still retaining the lug portion. The average thickness of these shoes was 31/32 in. at point of fracture. A representative high-speed road reported that they had purchased 63,400 plain chilled iron brake shoes during a period of three years. Comparative road tests which they had made showed that 25,350 shoes with an expanded metal insert would have given the same service with a saving of about $10,580 per year. Cases were cited where roads had been following the practice for years of finishing out the wear of expanded-metal insert shoes on freight cars with chilled iron wheels. Attention was also called to testing-machine records which showed that there is very little difference in co-efficient values for plain chilled shoes and those with expanded metal inserts on chilled cast wheels.

Advantages given by the subcommittee for expanded metal insert shoes are greater safety, adequate reinforcement of body metal, reduced breakage, higher coefficient values, and greater economy in spite of higher initial cost.

Drawings and proposed specifications for brake shoes with expanded metal inserts were submitted. The subcommittee report was signed by W. H. Clegg (chairman), T. L. Burton and R. C. Burns.

The report was signed by G. H. Wood (chairman), supervisor air brakes, A. T. and S. F.; W. H. Clegg (vice-chairman), chief inspector air brakes and car heating equipment, Can. Nat.; B. P. Flory, superintendent motive power, N. Y. O. & W.; T. L. Burton, air brake engineer, N. Y. C.; M. Purcell, general air brake inspector, No. Pac.; W. J. O'Neill, general mechanical superintendent, D. & R. G. W.; M. A. Kinney, general master mechanic, C. & O.; R. C. Burns, general foreman, Penna.; L. S. Ayer, general air brake inspector, So. Pac., and J. P. Stewart, general supervisor air brakes, Mo. Pac.

Action.—The report was accepted and necessary recommendations referred to letter ballot.

Couplers and Draft Gears

Draft Gear Approvals

Certificates of approval have been awarded covering two additional types of draft gears during the past year. The total number of types approved to date is nine, all of which are listed in the Code of Interchange rules dated January 1, 1935, and Supplement No. 1 issued March, 1935.

The A. A. R. draft gear testing laboratory at Purdue University has been engaged also in making periodic check tests of non-harmonic springs and special trucks—this work being performed for the car construction subcommittee in connection with endurance tests of these devices. When not required for A. A. R. work the laboratory has been kept busy on commercial testing of draft gears, springs and other devices for various manufacturers.

Reduction in Weight of Draft Gears

In an effort to ascertain what might be done to reduce the weight of existing draft gears, the subcommittee discussed this with representatives of the manufacturers. The results of the discussion are summarized substantially as follows:

(1) The opinion is practically unanimous that as a result of the combined efforts of the A. A. R. and draft-gear manufacturers during the past seven or eight years essentially the same things have already been accomplished with respect to draft gears that are now being sought in the consideration being given to reduction of weights of other equipment, although these results have been accomplished indirectly. The draft gear manufacturers several years ago were faced with the necessity of increasing cushioning capacity and improving substantially the performance of draft gears while, at the same time, they were limited almost automatically to the then existing draft-gear weights by reason of the fact that the draft-gear pocket dimensions were fixed.

(2) As a result, each manufacturer of existing certified draft gears has of necessity intensively studied every known means of obtaining the best possible gear within the space, and therefore the weight, limitations imposed. Evidence is found in the fact that all certified gears employ high-tensile steels with various heat treatments, which are designed to obtain the utmost possible value from each pound of metal.

(3) Notwithstanding the above facts, the opinion was expressed by two manufacturers' representatives that recent study had led them to the conclusion that further reduction of possibly eight or ten per cent in weight of their own gears might be made by various refinements without impairment of capacity or serviceability. In each case it was stated that some increase in cost would result but specific information as to how much this would be could not then be given.

(4) Attention was called to the probability, or at least possibility, that the recent marked improvement in draft gears may warrant some reduction in weight of certain other freight car parts, such as the striking casting for example. This should be especially true of box cars which are seldom loaded to full capacity and, in fact, to all cars of 50 or less tons capacity. The fact should not be overlooked that the same draft gear affords, in general, relatively better protection to the 40- or 50-ton car than to higher capacity cars.

(5) The suggestion also was made that consideration be given to the possibility of weight reduction in draft-gear followers which might be accomplished by use of cast steel suitably cored. The present weight of approximately 70 lb. each and the fact that two, and sometimes four, per car are used, suggest possibilities.

(6) The manufacturers' representatives were advised that it was not the desire, that weight reduction be attained by any sacrifice or impairment of performance or service life of existing certified gears.

(7) The manufacturers agreed to give further consideration, to this question of weight reduction in the hope that more might be accomplished. For the reasons outlined, however, it is the opinion of the subcommittee that no substantial reduction can be made except at the sacrifice of existing standards of efficiency and it is believed that these should not be impaired.

This subject is still an active one but there is nothing further to report at this time.

Obsolete Gears—Standard Gear

As proposed last year, the list of non-approved draft gears formerly shown under Interchange Rule 101, Section II, has been subdivided and those which could be definitely classed as obsolete have been placed in this category under Section III. There are many gears still listed under Section II which, in the opinion of the subcommittee, should be listed under Section III. It is hoped that the situation can be remedied during the coming year by agreement of all concerned.

It has been suggested that consideration be given to the desirability and practicability of adopting a single standard A. A. R. draft gear for freight cars. There are wide differences of opinion on this subject. Some objections cited are reminiscent of objections offered originally to the adoption of a standard coupler. On the other hand it is pointed out that the railroads have already attained by means of present standard specifications and certification of approved gears many advantages of standardization.

Regardless of the relative advantages and disadvantages of a standard gear, a comprehensive series of tests, including car impact and road tests, would be necessary before a single standard could be agreed upon. The cost of such tests would be considerable. The subcommittee has no recommendations to submit at this time.

The report on draft gears was signed by H. W. FAUS, chairman, H. W. CODDINGTON, H. I. GARCELON, L. H. SCHLATTER, and W. BOHNSTENGEL.

Type E Coupler

Gaging and Interchangeability of Type E Coupler and Component Parts.—Since the last meeting the coupler manufacturers have checked their respective Type-E coupler products for conformity with standard gages and interchangeability with products of other manufacturers.

One coupler fitted complete for rotary operation, one swivel-butt casting with swivel pin and one vertical-plane swivel yoke were submitted by each of the seven coupler manufacturers, one company submitting two sets of specimens representing the products of two separate foundries. In general, the results were quite satisfactory. There were, however, a number of instances in which the requirements of the various gages and fitting conditions were not met in an entirely satisfactory manner; to these the attention of the manufacturers concerned was directed for correction. Your committee has on file a detailed record of this inspection.

Coupler Reclamation—Welding Knuckle-Tail Back Wall.—Considerable attention is being given to the welding of knuckle-tail back wall in coupler bars. This repair operation had been more or less neglected until handling lines began to make these repairs. Under existing rules such bars are classified as scrap, but after being welded, are restored to second-hand value. This reclamation practice on the part of handling lines proves quite profitable, and owners are now giving attention to repair of owned couplers. It has been observed that some of these welded knuckle-tail back walls are failing in the same section, which leads to the opinion that the roads are not following the prescribed practice of thoroughly normalizing the bar after the welding operation. Unless repaired in accordance with A. A. R. recognized practice they should not be billed as second-hand value when placed on a foreign car. It is recommended that couplers welded in the knuckle-tail back wall section have the road initials, shop symbol and date stenciled over the welded section with 3/8 in. steel pencil; the stenciling to indicate that the work has been performed in accordance with A. A. R. practice.

Specification M-201-34 Covering Carbon Steel Castings.—Included in the specifications submitted for approval in letter ballot, January 7, 1935, was Spec. M-201-34 covering carbon-steel castings. The scope of this specification included coupler and coupler parts. Since the material used in couplers and coupler parts is of a special composition and requires observance of certain treatments and foundry practices not required with the ordinary run of steel castings, it is recommended that reference to couplers and coupler parts be removed from Spec. M-201-34 and the specification for coupler materials and parts remain as now published in the Manual.

Lightening the Weight of Type E Coupler.—In connection with the study during the past year relating to lightening the weight of car equipment, this committee was called upon to determine what might be accomplished in weight reduction with the Type-E coupler. This was presented to the manufacturers who, through their mechanical committee, made a careful study of it. It was realized from the first that any reduction in weight must be obtained through a reduction in section dimensions as the result of using a grade of steel superior in physical properties to Grade B steel. The minimum physical properties tentatively suggested corresponded to the following:

Tensile strength, 90,000 lb. per sq. in.; yield point, 60,000 lb. per sq. in.; elongation in 2 in., 22 per cent; reduction of area, 40 per cent.

The several heats of steel represented by the couplers and yokes subjected to these preliminary tests satisfactorily met the above physical properties.

In the accompanying tabulation the approximate weights of the reduced-weight couplers and yokes are shown in comparison with present normal weights for standard Grade B steel couplers and yokes.

The weights for the reduced-weight couplers and yokes are based on a limited number of castings, and will require adjustment later to complete the correct range of weights.

These changes in design have been made in a manner to preserve interchangeability with existing standard Type-E couplers, coupler fittings and yokes. The present standard gages will be used for gaging the reduced-weight coupler, coupler parts and yokes.

The manufacturers estimate the reductions in weight of approximately 100 lb. in the coupler assembly, and 60 lb. in the yoke will increase the cost of these parts approximately 20 to

Approximate Weights of Couplers and Yokes

	Grade-B steel present normal weights	Reduced weight, approximate normal
Coupler body, rigid shank	312	235
Coupler body, swivel shank	312	235
Knuckle	99	76
Other fittings (top or rotary operation)	34	34
Swivel butt casting	76	64
Swivel pin	11.5	11.5
Complete coupler, rigid shank	445	345
Complete coupler, swivel shank (without butt and pin)	445	345
Complete coupler, swivel, shank (with butt and pin)	533	421
Vertical plane (horiz. key) yoke	207	150
Vertical plane swivel yoke	217	155

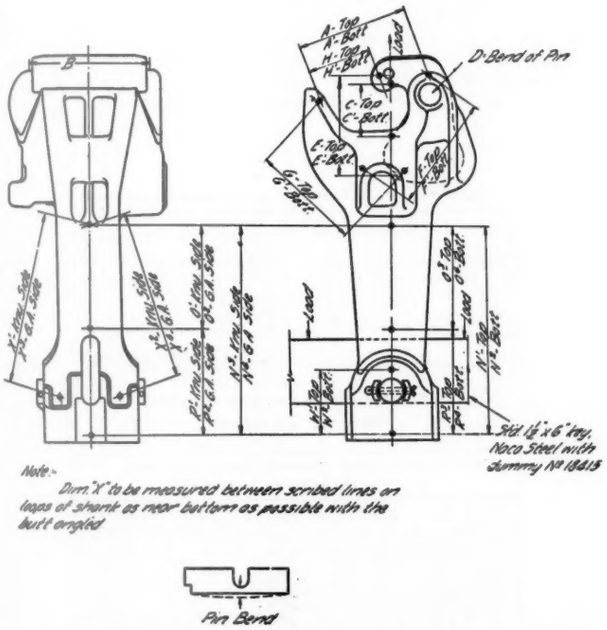


Fig. 1—Arrangement and location of readings for conducting static tensile tests on A.A.R. Type E coupler with 6¼-in. by 8-in. swivel-butt shank

25 per cent. This increase is attributed to the care that will have to be exercised in foundry practice to obtain satisfactory castings with reduced sections, as well as the more costly constituents that will be required in the high-tensile steel to meet the desired physical properties.

The following is a detailed record of the test to which these reduced-weight couplers and parts were subjected, with results compared with the present standard Type E coupler of Grade B steel:

Static Tensile (Pull) Tests

The couplers subjected to this test consisted of four reduced-weight E couplers, two with rigid shanks and two with swivel shanks. Comparisons are made with results of thirty-six tests of Grade B steel standard E couplers (25 with rigid shanks and 11 with swivel shanks), previously conducted by the Mechanical Committee of the coupler manufacturers. The arrangement for conducting the tests and the location of the various head and shank readings taken are shown, Figs. 1 and 2, for the swivel and rigid shank couplers respectively.

During all tests, both head and shank readings were taken after each load increment of 50,000 lb. until fracture of the knuckle occurred. A special steel knuckle was then substituted and the test continued to destruction of the bar, readings of the shank dimensions only being taken.

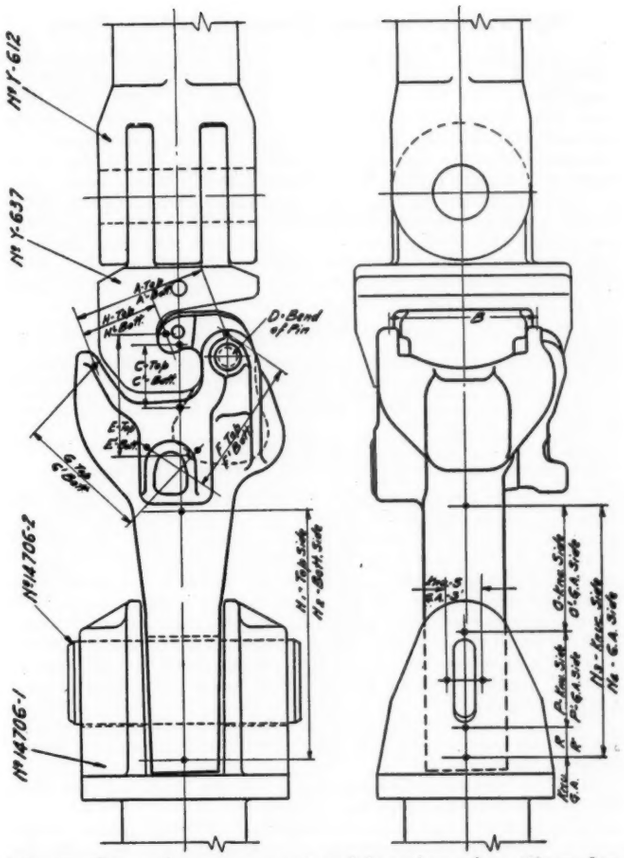


Fig. 2—General arrangement and location of readings for conducting static tensile tests on Type E couplers with rigid shank

Comparison of the Strength of the Two Coupler Designs

Design	No. tests	Knuckle ult. strength, lb.	Yield point load @ .01 set dim. A, lb.	Av. perm. set @ 400,000 lb. dim. A, in.	Bar ult. strength, lb.
Coupler Head					
Grade-B steel standard E	36	537,500	390,000	.013	703,500
Reduced-weight E	4	597,700	485,000	.000	727,400

Design	No. tests	Yield point load @ .01 set, dims. N, lb.	Average perm. overall, dim. N, in.	Set @ load of 600,000 lb. Fwd. slot, dim. O, in.	Set @ load of 600,000 lb. Front of slot to butt, dim. R, in.
Coupler Shank					
Grade-B steel std. E rigid	25	525,000	.033	.015	.041
Reduced-weight E rigid	2	625,000	.008	.000	.022
Grade-B steel std. E swivel	11	250,000	.299	.015	.288
Reduced-weight E swivel	2	450,000	.131	.000	.135

[Graphic charts showing results of this and also succeeding tests accompanied the report. The committee also submitted results on static compression tests, static front face tests, dynamic compression (strike) tests, dynamic flexure (guard arm) tests and also static tensile tests of vertical-plane yokes.—Editor.]

Continued Use of Type D Coupler Bodies

Action by letter ballot in 1933 authorized the coupler manufacturers to dispose of patterns, core boxes and gages covering Type D coupler bodies. It has been brought to the committee's attention that some roads are still insisting upon the manufacturers supplying the Type D coupler bodies. The Type E coupler was adopted because of its superiority in design and strength. The Coupler Committee finds it necessary in order to protect in interchange the interest of the large majority of roads conforming to the use of the A. A. R. standard Type E coupler to recommend to the Arbitration Committee that Rule 101 be revised so that after January 1, 1936, a new Type D coupler cannot be applied to a foreign car at other than second-hand value.

Tightening Contour Lines to Reduce Slack

L. K. Sillcox, Chairman of the Federal Co-ordinator's Mechanical Advisory Committee, has referred to the committee a suggestion from The Symington Company to tighten the contour lines of couplers from 43/64 in. to ¼ in., and thereby reduce unresisted slack in trains. This suggestion was accompanied by sketches indicating the impracticability of considering the tightening of coupler contour lines unless certain changes were made in car construction to accommodate additional vertical and horizontal angling. A sub-committee was appointed to study this suggestion and confer with the coupler manufacturers mechanical committee. In closing the contour lines as suggested there were items other than horizontal and vertical angling to be given consideration, as follows:

1—The effect on coupler operation as regards the lock dropping when coupling under impact.
2—The effect on train operation, particularly with respect to the unresisted slack required in starting trains on heavy grades. The reduction in existing free slack which will be greatly improved by the application of certified draft gears and the tightening of the permissible slack limits in draft gear maintenance.
3—The practicability of the coupler arrangement design to provide the necessary horizontal and vertical angling.
4—The interchange or interference with existing equipment.

At a joint meeting careful consideration was given to the various factors that could be foreseen as involved in this suggested change for tightening coupler contour lines. Donald S. Barrows, representing The Symington Company, presented a full report of the study they had made of the items of design that would be involved in the event the coupler contour lines were closed as recommended, presenting at the same time drawings descriptive of the changes that would be involved, one of which was a spring-supported or resilient coupler carrier to provide for vertical angling. At the conclusion he made the following recommendation:

"It is respectfully suggested to the joint committee that simultaneous investigations be authorized and energetically prosecuted to determine—

"1—The mechanical practicability of the modified and new details shown on the drawings submitted.

"2—The minimum horizontal and vertical track curves which can be negotiated by equipment of various lengths and with the modifications covered by the drawings referred to, allowance being made for all permissible lateral shift and comparisons drawn between operating conditions with (a) both cars modified as proposed, and (b) one car modified and the other in accordance with present standards, and also that—

"3—The report of these committees recommends to the Coupler and Draft Gear Committee that road tests be made to determine the effect on train operation of a reduction in coupler face clearance to approximately ¼ in., and that such tests could properly be combined with any other road tests which the full committee may have scheduled."

The reaction of your committee to this suggested change for reducing unresisted slack in train service is expressed in the following, quoted from the concluding pages of the report:

"After a full discussion of the means suggested by The Symington Company to provide for the possible reduction of 7/16 in. (this includes knuckle back lash), unresisted slack per car by tightening the contour lines, your committee expressed the opinion if unresisted slack reduction was the primary goal to be realized as the result of the changes necessary in the car equipment in order to bring about a reduction in unresisted slack of 7/16 in. per car that the changes required would not be justified in view of the existing unresisted slack in the draft gear and coupler attachments. The present A. A. R. recommendation for giving attention to the draft gear condition on owned cars when such cars are on the shop track is 1½ in. unresisted slack per end, which might mean 3 in. per car. If the slack reaches this amount in either end of the car, the draft gear must be dropped and the slack taken up. The 1½ in. limit was established because of the high percentage of cars that will require attention even under this limit. It appears to your committee that with such an opportunity for taking up unresisted slack in the draft gear and coupler attachments of 3 in. per car there would be no consistency in attempting to recover an additional 7/16 in. slack per car by the extensive construction changes indicated by the report made by The Symington Company.

"The means suggested by The Symington Company of using a yielding spring-supported coupler carrier to provide for vertical angling would react to a greater number of couplers slipping over, with attendant disastrous results to the equipment in the train where this condition occurs. It is the opinion of your committee that this means of providing for vertical angling is not practical.

"It must be further recognized that all new draft gears applied to cars that will accommodate the use of certified gears must be of the certified type. This is going to react to a tremendous extent to a reduction in unresisted slack in the draft gear section of the car.

"Application of Type AB brake, while not affecting draft gear and coupler slack, nevertheless should be recognized as an effective means of overcoming the disturbing influence of existing unresisted slack.

"After careful consideration of this subject your committee is of the opinion—

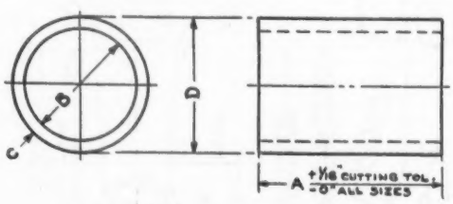
"1—That appreciable and effective reduction in unresisted slack will be realized through the application of certified draft gears and the reduction of unresisted slack through compliance with the draft gear maintenance program that was established the first of this year.

"2—That the application of Type AB brakes, while not affecting the amount of slack in couplers and draft gears, will provide a system of braking that will render less disturbing unresisted slack in the train.

"3—That the means for providing vertical angling by employing a yielding coupler carrier is not a practical and safe arrangement.

"4—That the means suggested for the reduction of 7/16 in. unresisted slack per car by tightening the coupler contour lines over the present standard 10-A contour line is not justified because of the extensive changes that would have to be made in the present car construction, coupler and attachment designs.

"5—That tightening the contour lines as a means of reducing unresisted slack is the most difficult and expensive method of accomplishing such a result, because of the extensive construction changes that necessarily accompany the change in contour. There is still the question of coupler operation, effect on train



COLD DRAWN SEAMLESS TUBING
40 - 50 CARBON

BUSHINGS FOR SHANK DESIGNS WITH PIN IN QUADRUPLE SHEAR

PIN SIZE	A	B	C	D	INSIDE DIAMETER TOLERANCE	OUTSIDE DIAMETER TOLERANCE
2	2 1/16	2 1/16	1/4	2 5/16	+.000 -.010	+.010 -.000
2 1/4	2 1/16	2 5/16	1/4	2 13/16	"	"
2 1/2	2 5/16	2 5/16	1/4	3 1/16	"	"
3	2 15/16	3 1/16	1/4	3 5/16	+.010 -.010	+.015 -.000

BUSHINGS FOR SHANK DESIGNS WITH PIN IN DOUBLE SHEAR

PIN SIZE	A	B	C	D	INSIDE DIAMETER TOLERANCE	OUTSIDE DIAMETER TOLERANCE
2	5 1/8	2 1/16	5/16	2 11/16	+.000 -.010	+.010 -.000
2 1/4	5 1/8	2 5/16	5/16	2 13/16	"	"
2 1/4	5 1/8	2 5/16	5/16	2 13/16	"	"
2 1/2	5 1/8	2 5/16	5/16	3 3/16	"	"
2 1/2	6 3/4	2 5/16	5/16	3 3/16	"	"
2 3/4	5 1/8	2 15/16	5/16	3 7/16	"	"
2 3/4	6 3/8	2 15/16	5/16	3 7/16	"	"
3	4 7/8	3 1/16	5/16	3 11/16	+.010 -.010	+.015 -.000
3	5 1/8	3 1/16	5/16	3 11/16	"	"
3	6 3/8	3 1/16	5/16	3 11/16	"	"
3 1/2	8 1/8	3 5/16	5/16	4 3/16	"	"

NOTE:- BUSHING LENGTH "A" SHOWN ABOVE IS BASED AS FOLLOWS:-
1/16" LESS THAN NORMAL SHANK HEIGHT FOR HEIGHTS UP TO & INCLUDING 3"
1/8" LESS THAN NORMAL SHANK HEIGHT FOR HEIGHTS OVER 3"

Fig. 3—A.A.R. standard Type E coupler details of seamless-steel tube bushings for coupler shanks requiring swivel pins

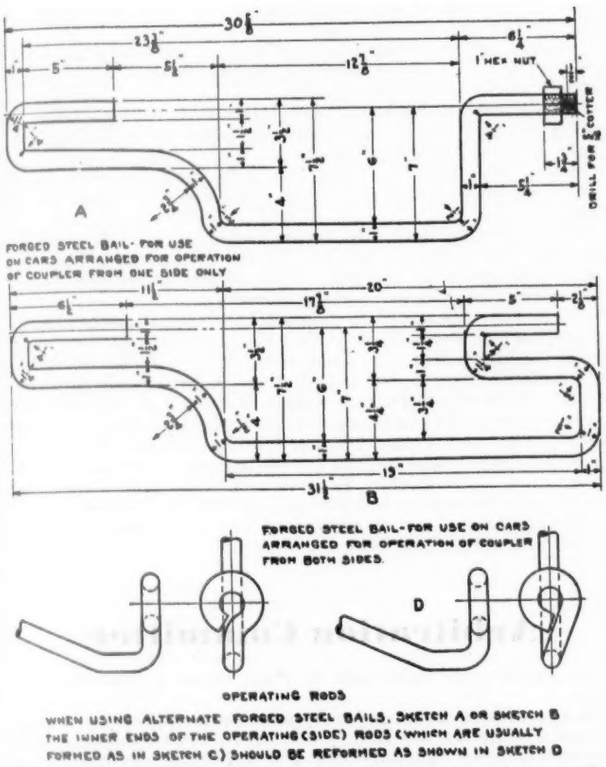


Fig. 4—Forged-steel rotary lock-lifter bails, Type 2, for A.A.R. standard Type E coupler uncoupling mechanism for passenger equipment

operation, interchange or interference with existing equipment to be established if the contour lines are tightened. It is the opinion of your committee that in view of the conditions stated there is no justification for giving further serious thought to accomplishing a reduction of 7/16 in. unresisted slack per car through the means of tightening present coupler contour lines."

Standardization of Coupler-Shank Bushings

In an effort to reduce to a minimum the variety of coupler-shank bushings that are required where swivel pins are used, the coupler manufacturers have made a study of the situation and recommend to the Coupler Committee standardizing coupler-shank bushing dimensions as shown in Fig. 3. Your committee has concurred in this recommendation, and the table of bushing dimensions as shown should be included in the Manual.

Forged Steel Rotary Lock Lifter Bail, Type 2

The association adopted as recommended practice, effective March 1, 1932, the No. 2 type of uncoupling mechanism for Type E couplers applied to passenger equipment cars. This equipment, as adopted, provided for a malleable iron lifter bail and lifter link, and was recommended for use in applying Type E couplers to new and existing cars. The coupler manufacturers mechanical committee has been studying this subject and has designed two forged steel bails that may be used as an alternate for the malleable iron bail. These bails are shown in Fig. 4.

Design A is for use on cars arranged for operation of coupler from one side only. Design B is arranged for operation of coupler from both sides. Design C shows the present form of eyes for the coupler operating side rods as recommended for use with malleable iron bail. Design D shows the recommended form of eyes for the side rods when used with either of the forged steel bails, A or B.

As it may be necessary to replace the malleable iron bails with wrought steel bails and operating rods, it is recommended that the designs shown be included in the Manual.

The report was signed by R. L. Kleine (chairman), assistant chief motive power, Pennsylvania; H. W. Coddington (vice-chairman), engineer of tests, Norfolk & Western; C. P. Van Gundy, engineer of tests, Baltimore & Ohio; C. J. Scudder, superintendent motive power and equipment, Delaware, Lackawanna & Western; Samuel Lynn, superintendent rolling stock, Pittsburgh & Lake Erie; L. P. Michael, chief mechanical engineer, Chicago & North Western; C. T. Ripley, chief mechanical engineer, Atchison, Topeka & Santa Fe.

Action.—The report was accepted and necessary recommendations submitted to letter ballot.

Prices for Labor and Materials

In order that the rules may currently provide an equitable basis for inter-road billing, your committee has continued the work of analyzing material, labor and new equipment costs in A. A. R. Interchange Rules 101, 107, 111 and 112 of the Freight Car Code, and Rules 21 and 22 of the Passenger Car Code, with a view of determining and recommending necessary changes to be made in the next supplement to the current Code.

RULE 101

All miscellaneous material prices in Rule 101 were rechecked as of March 1, 1935, quotations from purchasing agents of the 10 selected railroads, representing 39 per cent of total freight-car ownership in the United States and Canada, indicating little change in material markets as shown by detail recommendations for revision under this rule.

Items 116 to 134-A Inclusive.—In order to provide a more equitable method of charging for coupler parts, all applied labor has been eliminated from the material prices for such details and coupler-body prices modified accordingly, new labor items being incorporated in Rule 107 to cover.

Items 124-A and 125-A are modified to provide charge for former standard coupler bodies, either new or secondhand, on basis of secondhand value, to penalize the use of new former standard couplers in repairs to foreign cars. Items 124 and 125 are accordingly eliminated, so that change in body prices will not conflict with complete coupler allowances as provided in Rule 104.

Items 188 and 189 have been consolidated as new Item 188, at an average price, to eliminate difficulty in determination of correct price to apply under the former arrangement.

Item 203.—The first note has been modified to provide a more equitable method of charging for the 5½-in. by 11-in. non-AAR standard axle.

Draft Gears.—Several modifications in prices in Section II of the table for friction draft gears are recommended and one new item added. A new note is added to this section to provide that gears not listed in Sections I or II of the table shall be considered as obsolete types, in order to eliminate controversies as to proper credit where defective gears of obsolete types other than those mentioned in the table are removed. One type of gear has been transferred from Section II to the obsolete classification and five additional types (not previously mentioned) have been added to the obsolete list.

Weights.—The seventh and eighth items in the table of weights for miscellaneous items have been modified to provide a more equitable method of charging.

A new table of weights for K and H types of air-brake parts is recommended, to provide basis for scrap credit allowance and eliminate controversies in regard to same.

RULE 107

Items 51-A and 51-B have been added to this rule, to provide separate labor charge for application of coupler parts. A new section is added to *Item 99* to permit jacking, if necessary, in connection with repairs or renewal of dead lever guide brackets secured by rivets or renewal of its rivets only.

Items 109 and 136 are modified to provide charge for renailing slats and for plastic paper used as roof binder.

Item 113 is modified to permit charge for application of insulation to refrigerator cars in connection with renewal of braces.

Item 248 is eliminated, account covered by Item 249.

Items 270 and 271 are modified to eliminate overlap labor when turning steel wheels which are not dismounted. First note following Item 270 is also modified to harmonize with change in Interpretation No. 2 to Rule 98.

Items 231 and 296 are modified to clarify the intent.

Items 317 to 328, Inclusive, have been entirely revised and additional combinations added account confliction in truck combination labor charges. This study also developed modifications necessary in allowances specified opposite Items 14 and 254.

RULE 111

No modifications are recommended in this rule.

RULE 112

For the first time since 1931 a sufficient number of new cars

have been constructed upon which to base a recommendation for revision of reproduction pound prices for freight-train cars, so that supplement effective August 1, 1935, may reflect 1934 costs in lieu of figures shown in the present Code.

As Classes I and II tank cars have not been built since May, 1917, your committee has separated these classes from Classes III, 103, 103-A and 203 and recommends new reproduction pound prices for the latter on basis of 1934 actual costs, and that present per pound settlement prices for the Classes I and II cars be increased by the same percentage as obtains for the all-steel hopper car, which, it is felt, will provide a more equitable settlement basis.

The Class 203 tank car, insulated, with heater pipes, is similar in construction to the Class III insulated car with heater pipes and has been placed in the same group for settlement on reproduction cost basis.

Passenger Car Rule 21

Items 14, 14-A and 20-I are modified to clarify the intent.

New Item 20-K is added to provide allowance for cleaning and oiling slack adjuster.

Item 25-B is modified to harmonize with new fourth note added to Item 270 of Freight Rule 107. Third note following Item 26 is modified to harmonize with change in Interpretation No. 2 to Freight Rule 98.

Passenger Car Rule 22

Changes in material prices in a number of items under this rule are recommended, based on quotations as of March 1 from the purchasing agents of 10 representative railroads.

Items 12-A and 12-B are eliminated account combined with Items 11 and 12.

New Item 14-A is added to provide uniform charge for electric current used in charging storage batteries.

Item 17 and note following Item 54 have been modified to clarify the intent.

It is the intent of the committee to investigate labor and material costs again in October and if sufficient change develops, necessary revision will be made and inserted in the Rules effective January 1, 1936.

The changes recommended in the existing rules were included in detail as a part of the report.

The report was signed by A. E. Calkins (chairman), superintendent of equipment, N. Y. C.; H. H. Harvey (vice-chairman), general car foreman, C., B. & Q.; F. J. Dodds, general car inspector, A., T. & S. F.; P. Kass, superintendent car department, C., R. I. & P.; O. A. Wallace, supervisor car repairs, A. C. L.; T. J. Boring, general foreman, M. C. B. Clearing House, Penna.; H. E. Myers, master car builder, L. V.; H. H. Boyd, assistant chief motive power and rolling stock, Can. Pac.; A. E. Smith, vice-president, Union Tank Car Co., and A. H. Gaebler, superintendent car department, General American Transportation System.

Action.—The recommendations of the committee were approved and the report accepted.

Loading Rules

The committee recommended changes in the Loading Rules, as the result of meetings held with shippers and investigations conducted during the year, which are summarized as follows:

Rule 12 is revised to permit a single overhanging load weighing 25,000 lb. or less on the floor of all-steel or steel-underframe cars to use bearing pieces extending 1 ft. beyond each side of the lading, instead of requiring them to extend the full width of the car.

Rule 19.—The committee recommends the inclusion of a clause on inspection certificates among the clauses describing cards which are permitted to be applied to freight cars under interchange Rule 36. These certificates are to be used in accordance with the Loading Rules to show that machines of pivoted or swinging type have been properly inspected before being accepted from shippers. The provision of Rule 19 regarding inspection and carding of such shipments is amplified to clarify its intent.

The preface to the rules is reworded and instructions for experimental-load cards clarified.

Fig. 35.—The instructions with this figure are changed to provide that, when lumber of mixed lengths, 12 ft. or over, is loaded on flat cars, the longest pieces be placed outside the load to prevent projections over the sides of the car.

Fig. 45 is changed to provide for loading girders vertically on gondolas as well as flat cars as a measure of economy for shippers.

Fig. 52 is changed to provide for alternative blocking when Item "F" cannot be effectively applied to loads the height of which is less than the car sides.

Fig. 63a and accompanying specifications are drawn as an alternative to Fig. 63 for securing girders vertically on pivoted bolsters at the request of shippers.

Fig. 71 and accompanying specifications are provided for securing bundled sheet steel, oiled or plain, with high-tension bands or wires in gondola cars.

In *Fig. 157*, Item "C," and *Fig. 159*, Item "E," the use of rods with hooked ends has been prohibited as a measure of safety.

Slight changes were also recommended in Rule 8, Rule 16, Rule 18, Fig. 6, Fig. 43 and Fig. 57 for the purpose of clarifying or correcting the wording. Figs. 36 and 39 are modified in the interests of economy for the shippers.

The report was signed by Samuel Lynn (chairman), superintendent rolling stock, P. & L. E.; E. J. Robertson (vice-chairman), superintendent car department, M. St. P. & S. S. M.; R. H. Dyer, general car inspector, N. & W.; G. R. Lovejoy, master mechanic, Detroit Terminal Railway; T. O. Sechrist, assistant superintendent machinery, L. & N.; C. J. Nelson, superintendent of interchange, Chicago Car Interchange Bureau; H. S. Keppelman, superintendent car department, Reading; W. B. Moir, chief car inspector, Pennsylvania, and J. A. Deppe, assistant superintendent car department, C. M. St. P. & P.

Action.—The report was accepted and recommendations referred to letter ballot.

Arbitration Committee

During the year Cases 1737 to 1746, inclusive, have been decided.

Due to various designs of receptacles being applied for accommodation of defect and information cards, and continued recommendations from railroad clubs and car inspectors that same be provided as a safety measure and to facilitate inspection in interchange, a specification outlining minimum requirements in connection with design of such receptacle has been prepared which it is recommended be submitted to letter ballot for adoption as recommended practice.

The committee does not feel the other modifications included in its report necessitate submission to letter ballot, the majority of them being routine and covering changes recommended by the committees on Car Construction, Tank Cars and Couplers and Draft Gears, extensions of effective dates of various requirements and changes necessitated by letter ballot action last year.

No further extension in effective date beyond January 1, 1936, has been recommended for the requirements in Freight Rule 3 providing hand-brake connections on freight equipment cars must be of chain and that hatch covers on refrigerator cars must be secured by hinges, or for the requirement in Passenger Rule 2 covering location of platform safety chains. No requests for extension of these days have been received and it is considered that ample time has elapsed to permit compliance. For the same reason, the requirement in Passenger Rule 2, providing that cars other than passenger-carrying equipment must be equipped with metallic steam heat connectors, has been extended for only three months to January 1, 1936, with recommendation that no further extension be granted.

Numerous reports of accidents and delays occasioned by defective or missing brake hangers, hanger pins and cotters, box and column bolts, etc., and complaints as to failure of car owners to maintain properly these details on their own equipment, continue to be received, notwithstanding the fact that circulars have been issued from time to time calling attention to this condition. Your committee recommends that the items of cotters and small nuts be eliminated from Rule 108 (which prohibits billing for same) and a charge provided sufficient to cover the cost thereof; also, the addition of a new Rule 64 to the Code providing proper method of application of these details, as a safety measure.

Account complaints as to inequity involved in permitting charge on basis of value new for various items of secondhand material when applied to foreign cars, no re-use limits having been established for such items, a joint subcommittee consisting of members of the Arbitration and Car Construction committees of the Mechanical Division and representatives of the Purchases and Stores Division, was appointed to make study to determine the percentage of value new represented in the average secondhand wear life of such details. Your committee has listed twelve items for which it recommends charge on basis of 50 per cent of value new, when applied, secondhand, in repairs account of owner's defects or on authority of defect card. The joint subcommittee is continuing its study, based on wear value for the

secondhand parts, and with consideration as to whether additional items should be added to the list.

A number of complaints having been received as to failure of secondhand brake beams applied and charged at the allowance of 65 per cent of value new (permitted under the current rules), many of such beams apparently being but slightly above condemning limits when applied, a joint subcommittee, consisting of members of the Arbitration, Brake and Car Construction committees, was appointed with request that specification be provided which would result in a reclaimed beam of reasonably satisfactory service life expectancy to car owner and eliminate many failures now experienced as result of secondhand brake beam applications. This joint subcommittee has completed its report which will be submitted for letter ballot vote just as soon as approval of the various committees involved can be secured. Your committee has approved this report, subject to review of prices by the Committee on Prices for Labor and Materials and approval of the method of repairs by the Committee on Car Construction. If the specification is approved by letter-ballot action, your committee will immediately formulate the necessary changes suggested for the Interchange Rules.

All recommendations for changes in the Rules of Interchange submitted have been considered and where approved, changes have been recommended.

Attention is again directed to the fact that the Arbitration Committee will not consider questions under the Rules of Interchange unless submitted in the form of Arbitration Cases as per Rule 123.

Freight Car Rules

Rule 3

The committee recommends that effective dates for various requirements in the present rule as listed below, now set at January 1, 1936, be extended to January 1, 1937:

Section (a), Paragraph (6)—Axles under 70,000 lb. capacity cars.

Section (b), Paragraph (6)—Brake beam hangers with eyes not formed solid.

Section (b), Paragraph (8)—Bottom-rod and brake-beam safety supports.

Section (d), Paragraph (3)—Draft-key retainer.

Section (f), Paragraph (1)—Stake pockets on flat cars.

Section (f), Paragraph (2)—Stake pockets on flat cars.

Section (t), Paragraph (7)—Head block anchorage on tank cars.

Section (t), Paragraph (8)—Wood shims between longitudinal anchorage and underframe, on tank cars.

Section (t), Paragraph (13)—Dome covers secured by hinge or chain, on tank cars.

Also, that the effective date of Paragraph (7) of Section (b) of this rule, having reference to metal badge plate showing dimensions of brake levers standard to car, now set at January 1, 1936, be extended to January 1, 1938.

Reason.—The present situation justifies these extensions.

The committee recommends that a new Paragraph (5) be added to Section (a) of this rule, with Paragraphs (5) to (7) renumbered to require the equipping of triple valves cleaned after January 1, 1935, with heavy graduating springs, the former light-weight graduating springs being prohibited.

The committee recommends that a new paragraph and note be added following present Paragraph (2) of Section (t) of this rule, to be designated as Paragraph (3), and modification made in the note following the present Paragraph (2), with the renumbering of the subsequent paragraphs in Section (t), to become effective August 1, 1935, the purpose of which is to restrict the use of T- and L-section designs of cast-steel side frames as recommended by the Car Construction Committee.

The committee recommends that a new Paragraph (16) be added to Section (t) of this rule and included in the next supplement, to read as follows: To prohibit accepting Class I tank cars in interchange after January 1, 1936. This recommendation has the concurrence of the Committee on Tank Cars and the American Petroleum Institute.

The committee recommends that the first note following Paragraph (1) of Section (u) of this rule be modified, effective August 1, 1935, to include within the exception all cars using the A. A. R. Z-bar type center sill, as well as the 1932 standard steel-sheathed wood-lined box cor.

Rule 5

The committee recommends that the extended time limits of second paragraph of this rule, as shown in the 1935 Code, be continued until January 1, 1937.

Reason.—Account curtailment in car repairs resulting in holding of bad-order cars under present conditions.

Rule 17

The committee recommends that Paragraphs (1) and (2) of Section (b) of this rule be consolidated as new Paragraph (1), to make clear that the provisions of Paragraph (2) do not apply to other sections of this rule.

The committee recommends that a new last paragraph be added to Section (i) of this rule, to become effective August 1, 1935, to read as follows:

Proposed Form.—Secondhand non-approved friction draft gears may be substituted for gears of obsolete types, providing they are interchangeable as to sill spacing and coupler pocket limits. In case a new non-approved friction draft gear is applied in place of a non-approved or obsolete gear where the sill spacing and coupler pocket limits are such that an approved gear could be applied, charge for gear applied should be confined to secondhand value. In such cases no defect card is required, regardless of whether gear applied is new or secondhand.

Rule 18

The committee recommends that second and third sentences of first paragraph of this rule be modified as follows:

Proposed Form.—In the application of secondhand D and E couplers complete, *or new coupler bodies of same types,* distance between point of knuckle and guard arm must not exceed *5 in.,* measured *perpendicularly to guard arm.* In the repair of D and E couplers by the application of knuckle, lock or pin, any or all, *or the application of secondhand coupler body only,* the distance between point of knuckle and guard arm must not exceed 5⅛ in., as measured by gage shown in Figure B on page 47.

Reason.—To provide limits for application of secondhand D and E couplers complete or new coupler bodies of same types, as recommended by the Committee on Couplers and Draft Gears.

Rule 19

The committee recommends that the following items be added to this rule, as prohibitive repairs, effective August 1, 1935:

Proposed Form.—Brake beams, of capacity less than No. 2. Triple-valve graduating springs Nos. 1057 or QT 232.

Reason.—To stress the importance of prohibiting the use of this material in repairs to foreign cars.

The committee also recommends that the following item be added to this rule, as prohibitive repairs:

Proposed Form—Pressed-steel journal boxes, except when replaced in kind.

Reason: As pressed-steel boxes will be prohibited in interchange in 1938, substitution of same for other types should not be permitted.

Rule 20

The committee recommends that third paragraph of this rule be modified as follows:

Proposed Form.—The use of liners between male and female portions of center plates is prohibited where the vertical bearing surfaces are reduced, *except, in cases where side bearing clearance cannot be otherwise adjusted, the use of a one- or two-piece metal shim, not to exceed ⅛ in. in thickness, between the bearing surfaces of the upper and lower center plates, is permissible, providing the vertical bearing surface of the center plate is not reduced below 1⅛ in. No labor or material charge will be permitted for same.*

Reason: In some types of construction the use of shims between center plates is the only practical means of adjusting side bearing clearance. This recommendation has the approval of the Committee on Car Construction.

Rule 32

The committee recommends that the first paragraph of this rule be modified to make clear that the exception is intended to cover only the light sheet-metal closures used to protect tank-car insulation against weather conditions and should not be confused with insulated dome cover which serves as a closure to the tank.

Rule 49

The committee recommended that Section (a) of this rule be modified to set forth a standard location for the receptacles for defect, information and joint-evidence cards on each type of car, where such receptacles are used. This is a safety measure for car inspectors.

The committee recommends that the following specification for defect card receptacle be submitted to letter ballot for adoption as recommended practice:

Defect Card Receptacle

Recommended Practice

Adopted, 1935

Minimum requirements are as follows:

1—To be of metal, preferably rust-proof.
2—Inside dimensions, ½-in. by 4-in. by 8½-in.

3—To admit of efficient securement to wood or metal.
4—To admit of easy insertion and withdrawal of cards.
5—Outside face to be lettered "DEFECT CARDS."
6—So designed as to protect contents during inclement weather.
7—Cover optional. If designed with cover, however, such cover shall be self-closing and not open as result of vibration, wind or in handling cars over unloading machines.

RULE 60

The committee recommends that last sentence of Section (g) of this rule be modified in the next supplement to the current Code, as follows:

Proposed Form.—Effective January 1, 1935, triple valves applied in repairs to *all* cars must be equipped with the heavier type graduating springs (piece Nos. 18286 or QT 369), regardless of type in valve removed, for which no additional charge is permissible.

Reason: To clarify the intent that light weight graduating spring must not be used.

RULE 64

The committee recommends that a new rule be added to the Code, to read as follows:

Proposed Form.—Rule 64. No charge shall be made for the application of spring cotters or split keys unless of proper size and legs properly spread.

No charge shall be made for application of separate common nuts unless such nuts are fully tightened, and, where applied to journal-box bolts, column bolts or brake-hanger bolts, such common nuts must be secured with nut lock or lock nut.

Reason: To insure proper application of these details, as a safety measure.

RULE 70

The committee recommends that Sections (b) and (d) of this rule be modified to give the one-wear wrought-steel wheel the same protection as is now accorded to the cast-iron wheel by this rule.

RULE 83

The committee recommends that first paragraph of this rule be modified to prohibit the application of cast-iron wheels without any weight cast thereon, to conform with Rule 98.

RULE 88

The committee recommends that fourth paragraph of this rule be modified as follows:

Proposed Form.—Wrong wheels as outlined in Rule 70, Section (a), Paragraphs (1) to (5) inclusive. Bills to be rendered in accordance with Interpretation No. 4, Rule 98.

Reason: To provide for all cases where wrong wheels are substituted.

RULE 101

Attention has been directed to the fact that certain railroads continue to order new Type D coupler bodies, contrary to 1933 letter ballot action which authorized the manufacturers to scrap patterns, core boxes and gages covering Type D coupler bodies, in view of the adoption of the Type E as A. A. R. Standard.

Effective January 1, 1936, it is recommended that charge for such new Type D coupler bodies, when applied to foreign freight cars, shall be restricted to secondhand value.

RULE 108

The committee recommends that tenth item under Section (b) of this rule be modified effective August 1, 1935, as follows:

Proposed Form.—Seal hook, pin, or chain (any or all), *except where R. & R. or R. of one or more bolts or rivets is involved in the application of same.*

Reason: Charge should be permissible for repairs of this nature when the use of bolts or rivets is involved.

The committee recommends that the following items be eliminated from Section (b) of this rule and a charge provided for same with a minimum sufficient to cover the cost thereof:

Nuts, nut locks and lock nuts (including unit nuts), all types 1⅜ in. or smaller.

Spring cotters or split keys, under all conditions.

Reason: Failure to maintain these details is resulting in accidents and delaying the movement of cars.

RULE 112

The committee recommends that Section (j) of this rule be modified so that auto loading devices will be included among the items which the owner may instruct the handling line to return when he is requested to furnish the settlement value of a car under this rule.

The committee made slight modifications in Freight-Car Rule 8 to clarify its intent and in Freight-Car Rules 9 and 14 to conform with changes in other rules. Extension of time limits to January 1, 1937, was also recommended in the first paragraph of Rule 87 and the first paragraph of Rule 94.

Passenger-Car Rules

RULE 3

The committee recommends that a new last sentence be added to note following Paragraph (a) of this rule, to read as follows:

Proposed Form—Note.—In event line car is set out enroute account mechanical defects and another car substituted, line service expense shall be confined to full line mileage proportion of expense at originating terminal on original line car only. *In such case, where a car is cut out for any reason and another car not substituted to complete the run to destination, the proportion of terminal expense of the originating road should be confined to the point where car was cut out.*

Reason: To clarify the intent.

RULE 4

The committee recommends that a new second paragraph be added to this rule and included in the next supplement, to read as follows:

Proposed Form.—Effective January 1, 1937, all steel or steel underframe cars must be equipped with cardboards or suitable receptacle for the accommodation of defect and joint evidence cards. Same should preferably be located on center sill near center of car or other suitable location for visual inspection, same side of car and adjacent to air-brake stenciling. Size of cardboard, if used, shall not be less than 5½ in. by 9 in.

Reason: To provide for application of defect cards and joint evidence cards on passenger cars.

RULE 7

The committee recommends the revision of the second and third sentences of Paragraph (1) of Section (h) of this rule so that it conforms to the changes made in freight-car Rule 18.

Reason: To provide limits for application of secondhand D and E couplers complete or new coupler bodies of same types, as recommended by the Committee on Couplers and Draft Gears.

The committee recommends that note following Section (j) of this rule be modified, to read as follows:

Proposed Form—Note.—When U-12-BC type of U.C. control valve is removed, it should be replaced in kind, or, if replaced by U-12 or U-12-B valve, proper credit must be allowed car owner as outlined in notes following Item 20-C of Passenger Rule 21. In the substitution of the U-12-BC valve, for defective U-12 or U-12-B valve, car owner is not responsible for the betterment of improved cylinder cap having hair strainer, *unless the U-12-BC valve is standard to car as indicated by stenciling.*

Reason: Charge for betterment in such cases is justified.

RULE 8

The committee recommends that Item 4 of Section (a) of this rule be modified, and that a new Item 15 be added to this section, as follows:

Proposed Form.—(4) Impact in switching, exceeding damage to couplers and attachments, *draft-gear stops,* buffers and diaphragm face plates or parts thereof.

Reason: To clarify the intent and conform to Decision No. 1599.

Proposed Form.—(15) Center sill, one, or more, damaged, except when caused by emergency application of air brakes from engine cab, or due to bursting of air hose, breakage of coupler part, yoke or attachment. In such cases statement must be furnished showing circumstances under which the damage occurred, in order to establish responsibility of car owner for the repairs. Principle of Notes Nos. 1 and 2 under Freight Rule 32, applies.

Reason: Car owner is reasonably entitled to this protection.

The committee also recommends that item of *"release valves"* be added to Section (g) of this rule, covering missing material.

Reason: This item should properly be included with other items of missing material.

The report is signed by W. H. Flynn (chairman), general superintendent motive power and rolling stock, N. Y. C.; C. T. Ripley (vice-chairman), chief mechanical engineer, A. T. & S. F.; T. W. Demarest, general superintendent motive power, Penna.; T. Beaghen, Jr., superintendent car maintenance, Mexican Petroleum Corp.; J. J. Hennessey, assistant superintendent car department, C. M. St. P. & P.; L. Richardson, mechanical assistant to vice-president and general manager, B. & M.; G. E. McCoy, assistant general superintendent car equipment, Can. Nat., and M. F. Covert, general superintendent equipment, General American Car Co.

Action.—The report was accepted and recommendations referred to letter ballot.

EDITORIALS

The Minor Railway Mechanical Associations

In spite of the fact that at last reports several of the minor mechanical associations are going ahead with their programs for two-day meetings in September, it now appears that the officers of the Association of American Railroads and the members of the General Committee of its Mechanical Division have turned "thumbs down" on these activities. Members can attend the meetings if they go on their own time and at their own expense!

If this action is based purely on the economic conditions which exist at this time it can quite possibly be justified, although opinions differ widely in this respect. Those at the head of the Association of American Railroads and its Mechanical Division obviously should be better fitted to passed judgment on matters of this kind than those lower down the ladder. Aside from economic conditions, however, a strong impression seems to prevail that the higher-ups are not in sympathy with some of the minor mechanical associations and believe that they should not be encouraged. There is naturally plenty of room for argument on this point.

Will They Fight For Existence?

Let us hope that the members of those associations which are concerned will put up a strong fight for their continuance. It must not be forgotten that the American Railway Master Mechanics' Association and the Master Car Builders' Association were started as unofficial bodies, having no organic tie to the American Railway Association; indeed, until they were taken over by the latter association the memberships were individual, except, of course, when it came to voting on letter ballot for standards and recommended practices. The good which these associations accomplished in direct results, as non-official bodies, is beyond computation. If in addition it were possible to estimate the value of the inspiration and educational assistance which they gave to their individual members, the debt which the railways owe these associations would be quite beyond comprehension.

There has been a large turnover in mechanical department officers and foremen during the past five years. The new supervisors who have been advanced, if they are to make the most of themselves, must broaden their viewpoints and contacts and increase their technical knowledge. Meetings with their fellows offer an excellent means of so doing. Unfortunately, however, the national organizations to which they would naturally turn have almost ceased to function in recent years. There is a real need for their revival and it is difficult to understand why, if it is not advisable for them to meet at this time, the general officers in turning them down did not offer some encouragement for their continued functioning.

Railroads Have Been Greatly Benefited

Those of us who have attended the conventions of the minor railway mechanical associations over the years can recall hundreds of instances of men who have been fired with inspiration and new ideals as they have met with their fellows at the annual conventions and have secured a new and larger vision of their duties and responsibilities, together with much practical knowledge. Take the case, for instance, of a middle-aged shop foreman, who was well satisfied with his work, but who was induced to attend a convention of his fellow craftsmen. He went back to his job a new man and the shop over which he presided quickly advanced from an average position to one of the best conducted in the country, with resulting large savings to his particular railroad. Or consider another typical case of a young man with some promise, but with no strong convictions as to just how he could fit himself for advancement. The contacts which he made at the first convention he attended and the inspiration he received made possible rapid advancement and a large contribution to improved efficiency in the mechanical department of his road.

Pertinent Questions

Now, at the very time when some of the older men are greatly in need of help and inspiration and when the railroads are sorely in need of capable young men, one large factor in their training may be removed. Can the railroads at large afford to make such a sacrifice, even though it may appear to be in the interest of immediate economy? Have the higher officers forgotten their earlier experiences and what such associations and conventions have meant to them and to those with whom they have been associated?

It may be pertinent to ask a few other questions. Why have the American Railway Engineering Association and the minor organizations in that field, made a better record than the Mechanical Division and the minor mechanical associations in holding meetings and conventions in recent years? Is it because the civil engineering group are of more value and importance to the railroads than the mechanical group?

Is it not high time that this whole matter of railway associations, and particularly of the minor associations, was critically studied and measures taken to conserve the values in these organizations? Surely, in these days when our techniques and practices are so much more complicated and involved than in the past, it is

more important than ever that the different groups of specialists should be so organized as to make the largest possible contribution to the railways, both in the advancement of technical knowledge and also in those intangibles which are so vital in building up a strong morale.

Signs of Spring After a Hard Winter

On June 26 and 27 the Mechanical Division of the Association of American Railroads held its fourteenth annual meeting, thus resuming the regular course of its constitutional activity which has been interrupted since the thirteenth annual meeting was held in 1932. In view of the long interim during which the affairs of the division have been, of necessity, subject to bureaucratic conduct, one might, in anticipation of the event, have expected almost anything in the way of attendance and interest in the meeting. There might have been a large turn-out of members interested in resuming some share in shaping the course of action of the division by the critical discussion of the reports prior to the submission of recommendations to letter ballot. On the other hand, the long interval without a meeting might have engendered an apathy which would make the members reluctant to turn out, especially since there has been no let-down in the quality of the committee work.

The attendance of railway men was less than 150, but, because of the generally small delegations from individual railroads, this represented a large number of the important railroads belonging to the association. Relatively little interest was shown in the discussion of the reports. Several explanations of this situation may be offered. One is that the work of the committees is so comprehensive that most of the questions or objections which might be raised to any part of a report on the floor have already been taken into consideration by the committee, thereby leaving little room for anything of value to be brought out by the members not on the committee. Another possible explanation is that the monotonous verbatim presentation of long reports in itself tends to cause a loss of interest in the proceedings. Most of these reports are of such a character that few members can enter into an intelligent discussion of them without first having given them at least one careful reading. A verbatim presentation of the report during the meeting is no substitute for such a reading and, since the reports, with few exceptions, are all mailed to the members in advance of the meeting, the necessity or, indeed, the advisability of allowing the committee a verbatim reading of its report at the meeting may be seriously questioned. The reports could, without doubt, be brought effectively before the members for discussion in not more than half the time now consumed in reading them and, certainly, with an increase of the general interest and value of the proceedings to the members. The presentation of this year's Arbitration Committee report gives an indication of what may be accomplished in this direction.

Since the last joint convention and exhibit at Atlantic City in 1930 many developments have taken place in railway motive power and rolling stock. New materials of construction have been brought to commercial development and the railways have already begun to utilize them on an extensive experimental basis. While no thought of a formal exhibit in connection with the recent meeting of the Mechanical Division was entertained, the pressure of new developments was such that a very respectable exhibit of new forms of freight-car construction was brought together, spontaneously, at Chicago, although not in a single location. These cars, which are described elsewhere in this issue, represent the contributions of a number of builders using some of the new corrosion-resisting alloys to bring about much needed reductions in tare weight.

Developments during the depression years are by no means confined to new materials of car construction. What could do more to restore a sane perspective within the industry than a comprehensive exhibit of the vast technical changes and improvements which have been taking place since 1930?

The Extravagance of Poor Tools

Machine work in locomotive repairs is of extreme importance for upon the accuracy and the quality of the machining depend, to a great extent, the service life that may be expected from the moving parts of a locomotive. Within recent years the mileages of locomotives between shoppings for general repairs have been considerably extended to a point where it is not uncommon to expect modern power to make from 120,000 to 150,000 miles between general shoppings. In order to accomplish this the demands upon the shop for workmanship of higher quality and greater accuracy have been increasingly greater with each passing year. And, strange to say, those who are responsible for the determination of shop policies seem to have expected the shop forces to turn out this greater locomotive service mileage with machine tools and shop equipment that decreases in productive efficiency as each year is added to its age. During the past six years, particularly, no regular program of replacement has been carried out.

Machine tools of advanced age are, in the majority of instances, a distinct liability for the reason that because of advancements in the art of building machines, the modern designs are capable of producing locomotive

parts at a considerable saving. The experience of those shops in which some modern tools have been installed has demonstrated that the increase in productive capacity has made it possible to pay for modern machines in relatively short periods. In addition, studies which have been made demonstrate conclusively that the annual repair costs on machines which have been in service from 15 to 25 years are from two to three times as great as the repair costs on machines less than ten to fifteen years old. Incidental savings as a result of the installation of modern machine-tool equipment which are not generally taken into consideration are those of decreased power costs as a result of reduced machine power requirements and reduced machine operating hours. All of these are direct savings accomplished within the machine itself and do not take into consideration the important indirect advantages of more accurate and higher quality workmanship on locomotive parts.

It has been pointed out many times in these columns that future economies in railroad operation will probably have to be realized as a result of savings effected by the installation of more productive facilities, for we know that the railroads cannot reasonably expect to pay for additions to and replacements of facilities from increasing operating revenues brought about by national and industrial expansion. It has also been pointed out that one of the greatest immediate opportunities for effecting economies in railroad operation lies in the field of locomotive repair work which, for several years, has constituted an expenditure of considerable magnitude.

As compared with some other industries which must rely upon efficient machine-tool equipment to carry on their operations, the railroads have been slow to recognize the advantages which could be realized by carrying out a systematic program of repair-shop modernization. Some indication of this fact may be seen in recently compiled statistics which show that over a period of years the railroads have spent less than four per cent of the money expended for additions and betterments to railroad property upon shops, enginehouses and machine tools, which facilities are used for maintaining equipment the expenditure for which represents over one-fourth of their entire operating expenses. In the case of those roads which have realized the value of modern repair equipment, the evidence of this value may be seen in the low unit costs of locomotive and car repair work. The chief executive of one such road which has profited by the economies of modern equipment is credited with the statement that "A workman who continues to use poor tools to save the price of good ones is guilty of the worst brand of extravagance."

Conservative estimates which have been made in relation to railroad machine tools and shop equipment indicate that the savings which might be effected by the replacement of many types of machine tools over fifteen years of age would be sufficient to pay the cost of replacing the entire present inventory of railroad machine tools in a period of less than fifteen years. If this be true, it is evident that the cost of continuing poor tools in service is, indeed, the worst kind of extravagance.

The ability of modern shop machinery and equipment to pay for itself in a reasonable length of time has been amply demonstrated. The need for a program of shop-equipment replacements in the railroad industry is obvious if for no other reason than that so large a part of its present facilities are of advanced age and can be continued in service only at a loss. Now, within the past few weeks there has entered into the picture another factor of importance—the ability of the machinery manufacturers to supply the railroad demand when it arises. Many factors, some economic, some political and some financial, have combined to create a sudden demand for machine tools and should the railroads hesitate too long in getting into action on the matter of the equipment they need they will find themselves buying in a seller's market.

During the past five or six years, when necessity has forced the railroads to make drastic retrenchments in expenditures for new facilities, the machine-tool industry has been busy in the development of new designs which are far superior in productive capacity, low cost of operation and low machine repair costs to any machine-tool equipment built from ten to twenty years ago. What this industry has done to make available modern facilities for repair work involving machine operations is going to be placed upon exhibition at Cleveland, Ohio, from September 11 to 21 of this year, at what is expected to be one of the most elaborate displays of machinery and accessories ever held. Mechanical officers and supervisors owe it to themselves and to the companies which they represent to take advantage of the opportunity afforded by the 1935 Machine Tool Show to compare the ability of today's machine-tool equipment to perform railroad machining operations more efficiently and at a lower cost than the tools with which the average railroad shop is now equipped.

NEW BOOKS

COAL AND COAL PRODUCTS, *A List of Books and Other Information Regarding. By F. R. Wadleigh. Paper, 6 in. by 9 in., 64 pages. Price, $1.00. Copies may be obtained from the author, Cecil Apartments, 1026 Fifteenth street, N. W., Washington, D. C.*

Mr. Wadleigh, a consulting engineer, and formerly chief of the Coal Division of the Department of Commerce, was at one time associated with the Bureau of Mines, and served as federal fuel administrator during 1922-23. His list of books concerning coal and its use is most complete. It gives the title of the work, the name of the author, where published, and the date of publication.

Built by the American Car and Foundry Company of Cor-Ten steel. Welding was extensively used in their fabrication. Complete facilities are included for comfortable travel day and night

Light-Weight Motor Trains for Gulf, Mobile & Northern

THE Gulf, Mobile & Northern has purchased two Diesel-electric trains of streamlined form which were designed and built by the American Car and Foundry Company. U S S Cor-Ten steel is the principal material of construction. By the careful use of this material and the extensive employment of welding in the fabrication of the structure a large reduction in weight has been effected. The train, made up of three non-articulated car units, weighs 363,540 lb., of which over 48 per cent is in the power car. With the fourth car regularly added for a part of the run, the total weight is 458,210 lb.

The equipment of each of the two trains consists of a power car, 70 ft. 6 in. long inside, which weighs 175,800 lb.; a buffet-passenger coach, 74 ft. 4 in. long inside, which weighs 94,560 lb., and a sleeper-observation car, 74 ft. 11 7/16 in. long inside, which weighs 93,-180 lb. The seventh coach in the order, which, like the buffet coach, is 74 ft. 4 in. long, weighs 94,670 lb. The latter car, known as the "swing" coach, differs from the buffet coach only in the absence of the buffet in which facilities have been provided for complete electric grill service.

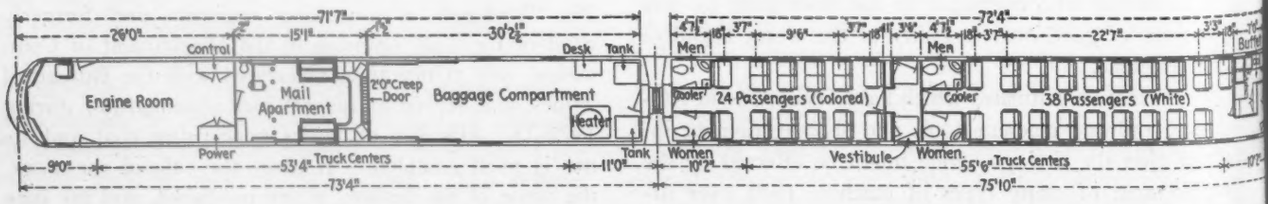
The trains, to be operated under the name of "The Rebel," indicating their relation to the traditional methods of transportation, will operate on the night runs between New Orleans, La., and Jackson, Tenn. This distance of 488 miles, including a maximum of 39 intermediate stops, will be made on a schedule of approximately 12 hours. The swing coach will be placed in the southbound train at Jackson, Miss., for the 186-mile run to New Orleans each morning and will be cut out at Jackson on the northbound run each evening. In addition to the passenger-train cars replaced the new equipment will displace three steam locomotives, two assigned between Jackson, Tenn., and Bogalusa, La., and the third, of lighter weight to meet Lake Pontchartrain bridge restrictions, between Bogalusa and New Orleans. With the installation of these trains the G. M. & N. will have completely replaced steam motive power in its passenger-train service by internal combustion motor cars.

The Underframe

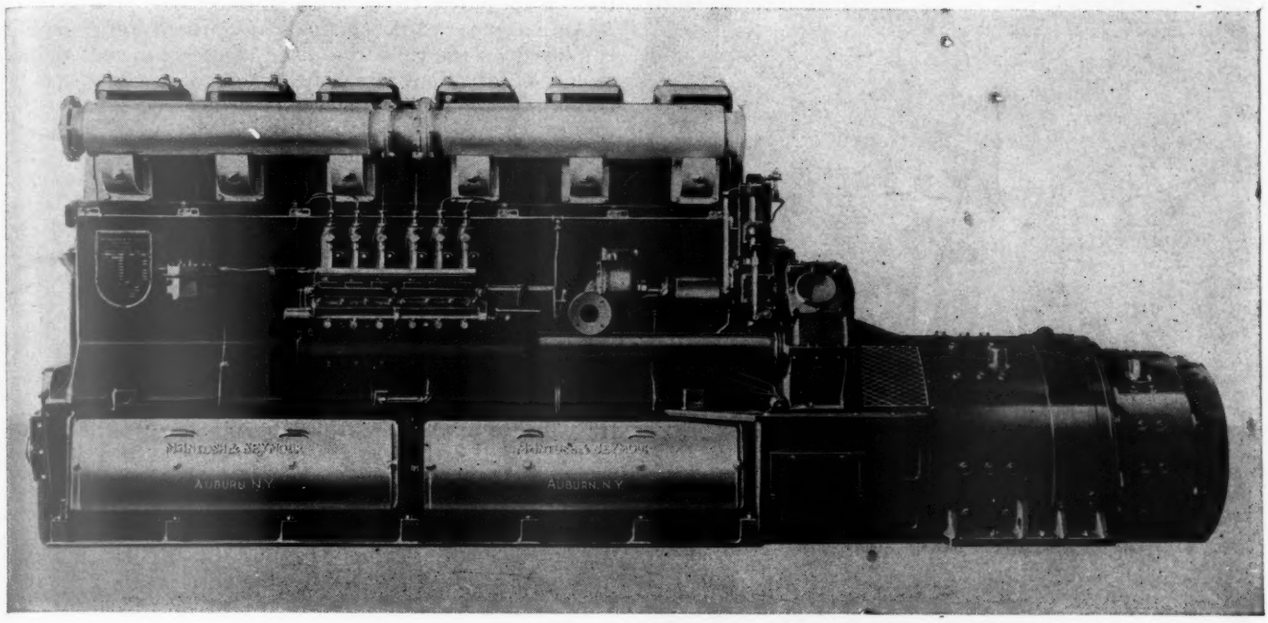
Aside from the center sills, the structure of the cars is built up on a framework consisting largely of pressed-steel members. Both the pressings and the sheets enclosing the exterior of the car are of U S S Cor-Ten steel. The center sills are 8-in., 11.5-lb. channels rolled of Cor-Ten steel which are spaced 18 in. apart, back to back, and joined by a 22-in. by 3/16-in. top cover plate. The side sill is a specially formed channel of 5/32-in. material with the flanges inward and a vertical leg turned up on the inner edge of the top flange and the web shaped to conform to the curve of the sheathing.

A pressed angle stiffener of 5/32-in. material is riveted to the turned-up flange of the side sill. The horizontal leg which is placed at the bottom serves as the side floor support.

The bolsters and crossbearers are built up of pressed metal pans and cover plates. The bolster pans are of 3/16-in. material and are placed with the 3-in. flanges



Floor plan of G., M.



The Alco type 660-hp. Diesel engine with welded cylinder block and base

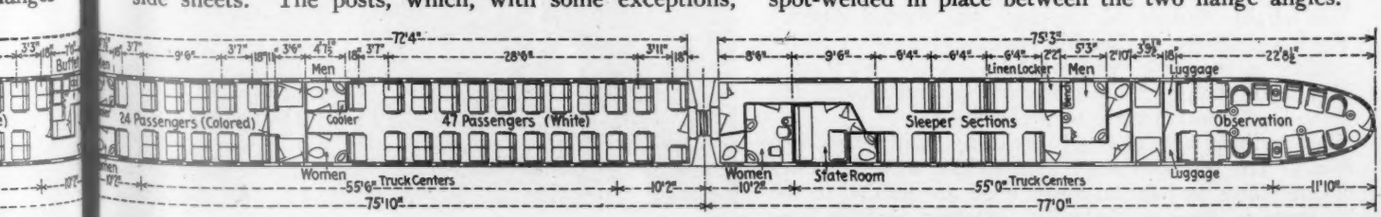
extending outward and joined by a $\frac{5}{16}$-in. top cover plate, 24 in. wide, and a $\frac{3}{8}$-in. bottom cover plate, 19 in. wide. The pans are riveted to the cover plates, center sills and bolster-center filler castings, and their outer ends are framed into the channel side sills. The crossbearers are single $\frac{5}{32}$-in. pans with pressed fillers between the center sills. Each is provided with a $\frac{3}{16}$-in. top cover plate, 6 in. wide, and a $\frac{5}{16}$-in. bottom cover plate, 4 in. wide.

There are no end vestibules on any of the cars. Each passenger-carrying car has a single vestibule which is placed between the two-passenger compartments of the coaches and between the sleeping and observation compartments of the sleeper-observation car. Where the side structure and underframe is cut away for the vestibule doors and step well the underframe is reinforced by two crossbearer diaphragms placed 2 ft. 3½ in. apart and covered by a ⅛-in. plate, 30 in. wide, which extends completely across the car over the center-sill cover plate and is riveted to the center sills and diaphragms. Individual bottom cover plates, 5¼ in. wide and of ¼-in. material, are riveted to the side sills and center sills as well as to the under side of each of these diaphragms. A bottom cover plate is also applied to the center sills at this location for a distance of 8 ft. 9⅞ in.

Welding Extensively Used in Sides and Roof

The side structure of the cars is unique not only in design, but also in the methods by which it was fabricated. The side posts consist of channel and angle pressings, the angles forming flanges on the open side of the channels by which the posts are secured to the side sheets. The posts, which, with some exceptions, are 6-$1\frac{1}{16}$ in. wide over the webs, are built up by spot welding. Instead of attaching the posts to the underframe and applying the side sheathing to the completed frame structure, side-sheet sections, varying somewhat in width, the widest of which include three window openings, are assembled with the side posts and other frame members in jigs and welded. The completed sections are then applied to the car underframe and the posts are secured to the side sills and each section joined to the one previously applied adjacent to it. A typical side section ready for application on the car is shown in one of the illustrations. It includes the $\frac{3}{32}$-in. sheet, two side posts, a belt-rail stiffener of formed Z-section and a top window stiffener of special Z-section with a channel recess formed in the long lower leg which extends down to the top of the window opening. These horizontal members, as well as the posts, are secured to the sheets by spot welding and the exteriors of the sheets are thus completely free from rivet heads. The horizontal members are also welded to the posts.

To each vertical edge of a side-sheet section is spot welded a 1½-in. by 2-in. by ⅛-in. angle; that at one edge extends about ½ in. beyond the edge of the sheet and that at the other edge is set back so that about ½ in. of plate extends beyond the face of the angle. Each side-sheet joint is located in the center of a side post. The angle member of the side post is spot welded to the sheet in the jig, but the channel section of the post is omitted until the sheets have been joined, first by riveting together the adjacent angle flanges and then by arc-welding the adjoining edges of the sheets on the outside. The channel portion of the post is then spot-welded in place between the two flange angles.



Diesel-electric train

The observation-lounge room

After the sides have been completely assembled on the car a belt rail of 3/16-in. plate, 3 in. wide, is placed in recesses provided in the backs of the posts and spot welded to the posts as well as to the inner flange of the Z-section belt-rail stiffener.

In the power car, where there are few window openings, the sheet sections are assembled in a single piece, extending continuously from the side plate to the bottom of the skirting below the underframe. In the passenger-carrying cars, where the windows are closely and regularly spaced, each sheet section is made up of top and bottom pieces joined by arc welding between the windows.

The bottom of the skirting is stiffened with a light angle spot welded in place and rigidity is further secured by gusset stiffeners which extend from the bottom of the sheet up to the side sill. In the power car, where required, the sheet panels are stiffened by light, shallow flanged channels running longitudinally, which are spot welded to the sheets.

The inward curve of the skirting begins above the side sill and the outside contour of the side posts are shaped accordingly. Similarly, the curve of the roof begins in the side of the car immediately above the tops of the windows. The side plate is a Z-pressing of 3/16-in. plate with the web placed horizontally and the lower and upper flanges conforming to the curve of the exterior and interior surfaces, respectively. Like the side sills, the plates are formed in several pieces which are joined by suitable splice members, riveted and welded in place.

The outside flanges of the posts are riveted directly to the lower flange of the side plate. The gusset plates extending up from the inside of the posts are also riveted to the inside flange of the plate and extend beyond the plate to be riveted directly to the carlines.

The carlines are channel pressings with the web vertical. The roof sheets are spot welded to the carlines and side plates and at the lower edge are welded to the side sheets to form an unbroken exterior surface from the bottom of the skirting on one side of the car over the top and down to the same point on the opposite side.

An exception to the methods of construction generally employed on the cars was made at the rear ends of the sleeper-observation cars. In order to provide smooth conformity to the long curves by which the sides of the car are carried around the rear end, the posts were attached to the underframe in the usual manner and the outside sheet, first hammered to shape on a wooden form, was welded on the frame members. After being thus tied into the car structure the rear door and the window openings were then cut from the sheet. The result is a smoothly curving surface free from waves.

The end construction consists of special corner posts, built up of 3/16-in. channel pressings and stiffened by several lighter formed sections, and 8-in., 17-lb. H-sections at the diaphragm posts. The bottoms of these posts are securely anchored to the buffer castings and body end sills, which are pressed pans, attached to the buffer casting, and flat cover plates, forming a complete tie across the car. The tops of the posts are secured to a 1/8-in. horizontal anti-telescoping plate 15 in. wide with a 2½-in. flange which is riveted to the posts. The telescoping plate is stiffened by a 2-in. by 2-in. by 3/16-in. angle which is riveted to its inner edge. A continuation of the rear end sheet is used to form the door frame.

The passenger-carrying cars have Keystone floors which are supported on light Z-section longitudinal stringers which rest upon the transverse 5-in. channels pressed from 1/8-in. material. The transverse recesses in the steel floor are filled with cork and then covered with a 1⅜-in. Armstrong cork floor, cemented on. A surface of 1/8-in. Masonite is then cemented over the cork. The vestibules and steps are surfaced with Super-Diamond floor plates.

The ceilings and sides of the cars are insulated with light-weight Salamander, 2 in. of which is applied against the roof sheets, held by wires passing through

The buffet coach

Designed and Built for

Gulf, Mobile & Northern Railroad

by

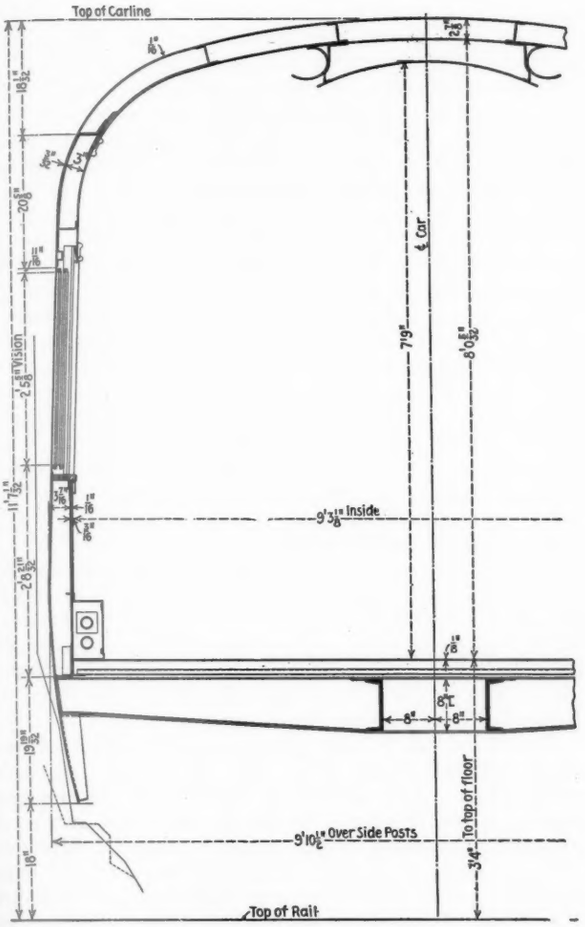
American Car and Foundry Company

ned and Built for

e & Northern Railroad

by

and Foundry Company



Typical section of one of the coaches

the carlines, and 2 in. against the outside sheets, secured by cement and spot-welded nails. Cemented to the head lining is a 1-in. layer of the same material and to the inside finish a ½-in. layer. The same material is also applied in the side posts and the vestibule bulkheads.

The head lining, frieze and pier panels are of 14-gage aluminum alloy sheets. The wainscoting is 5/16-in. Presdwood.

Between the purlines on either side of the car is secured a 1/16-in. steel plate which forms the top of the center air-distribution duct. To these are attached formed steel members which complete the air duct and are shaped so that the outer edges form the shields for the source of the indirect lighting of the car.

The Vestibules

The single entrance vestibule in each car is closed with side and trap doors of an unusual design. When closed, the bottom of the side doors extend down to the bottom of the skirting, thus producing the effect of an unbroken side surface. In order that they may swing back alongside the vestibule bulkhead when open, a section at the bottom of each door is hinged and is folded up inside the door before it opens. This permits the door to swing back into the step well above the second step.

The trap door, instead of opening from the side, is hinged directly to the inside of the side door and opens from the center. Links which connect the hinged section at the bottom of the side door with the under side of the trap door automatically fold up the former when the latter is lifted preparatory to opening the side door.

In each coach the bulkheads on one side of the vestibule have been set back about 11 in. from the trap door opening and lockers for lighting, air-conditioning and temperature control apparatus have been installed in the vestibule space thus provided. These are accessible from the vestibule when the side and trap doors are closed. Corner space in the corridor of the sleeping car has been utilized for control lockers in the sleeper-observation car.

The Diaphragm Construction

The diaphragms, developed by the car builder, which provide unbroken surfaces between the ends of adjoining cars, are supported at the bottom by the usual side buffer stems and at the top are alined by a pantagraph. The contact pressure between diaphragms is maintained by buffer springs at the bottom and by a semi-elliptic spring at the center of the top.

The outside contour of the outer face plate corresponds to the contour of the sides and roof. The space between this plate and the side and roof sheets is closed by a smooth canvas-backed rubber diaphragm, the back edge of which is kept to contour by attachment to an aluminum tube of stiff oval cross-section, alined and guided by two side stems at the bottom and one stem at the top. Tension is maintained on the diaphragm by cables attached to the aluminum tube which pass over sheaves to long coil springs which are disposed parallel to the end of the car. The side and roof sheets of the car extend 7 in. beyond the end sheet, thus concealing the back edge of the diaphragm and its supporting mechanism. The inner diaphragm enclosing the passage between cars is of the conventional folded type.

The Power-Car Structure

The construction of the power-car body is similar in general characteristics to that of the passenger-carrying cars. There are, however, a number of variations incidental to the special requirements of the power plant and motor truck. The channel-section center sills of the type already described are terminated at the cast-steel engine bed, into which they are securely tied. This casting also includes a portion of the bolster which is completed by supplementary arm castings and heavy top and bottom cover plates. The engine-bed casting ter-

The sleeping-car underframe

The structure of the observation compartment

minates about 3 ft. back of the front buffer casting to which it is attached by two formed Z-section sills of ½-in. plate in line with the center sills. These front sills, the buffer casting and the engine bed are tied into a stiff horizontal platform conforming to the curved ends of the car which consists of two ¼-in. horizontal plates spaced 5 in. apart and securely tied together by structural shapes placed between them.

To provide clearance for the motor truck at the rear end of the car the channels which form the main portion of the center sills terminate forward of the rear bolster, to be replaced by a raised section built-up of Z-bars and cover plates which is securely attached to the top of the main center sills by deep angle adapter pressings. These pressings are lapped back over the tops of the main center sills to transfer the bending load, and the top cover plate of the main center sill is continued forward as the bottom cover plate of the raised rear section of the center sill.

The front end structure consists of specially formed Z-section posts, the two at the front in line with the sills being 8 in. deep with 3-in. flanges. The rear flanges of these posts are straightened out where they pass through the ½-in. floor plate, are securely riveted to the buffer casting and are welded to the floor plate. A heavy anti-crash band of ⅜-in. plate, 16-in. wide, is wrapped around the front of the end frame at the junction of the end posts and buffer casting, the ends sloping down on either side and terminating at the junction with the front ends of the side sills.

The side and end plate at the front of the power car is of rolled angle section. The front hood and roof over the engine room is detachable and is secured to the body structure by bolting to the horizontal flange of this angle. To add stiffness at the top of the end structure the base of the hood assembly has a horizontal ¼-in. plate, 36 in. deep, suitably stiffened by angles.

The roof over the engine room is provided with a center monitor 4 in. high, which is carried downward over the hood and front end of the car to the window-sill level. This roof is removable in two sections. The rear section contains the oil and water radiators, which are removable with it, and the exhaust stack outlet. This portion of the roof contains the louvres for the radiator air supply.

The forward removable section covers the engine and generator and contains the exhaust muffler which is enclosed in a roof-ventilated housing. Two hinged hatches in the monitor top provide for access to the top of the engine. There are also two hinged hatches in the roof at the right side of the monitor. The engine room floor, which is considerably higher than the floor in the rest of the car, is of $\frac{3}{16}$-in. Super-Diamond plate.

The floor in the mail compartment is laid on 18-gage galvanized steel formed in pans and riveted to formed Z-section floor stringers. These pans are filled with ¾ in. Salamander. A 1-in. yellow pine floor is laid crosswise over the floor stringers. The finished floor is of ¾-in. tongue-and-groove yellow pine laid longitudinally over the lower course with building paper between.

The baggage car is floored with 1¾-in. shiplap yellow pine laid crosswise on longitudinal stringers, except at the rear end over the raised portion of the sills where it is ⅛-in. Super-Diamond steel plate supported directly over the sills and on Z-section intermediate stringers. The ceiling of the baggage car is finished with $\frac{1}{16}$-in. steel sheet screwed to the carlines. The sides are finished with corrugated steel.

The windows in the passenger-carrying cars are fitted with double pressed-aluminum fixed sash, the inner of which is removable to provide for cleaning, glazed with Pittsburgh plate glass. The outer sash has a $\frac{3}{16}$-in. pane and the inner a ¼-in. pane, the latter of shatter-proof glass. The single sash of the toilet rooms are fitted with Pressed Prism shatter-proof panes.

The windows in the power car are all closed with single sash which are fitted with ¼-in. panes of shatter-proof glass. The window at the side of the operator's station at the front end of the car and that in the corresponding position on the opposite side are fitted with strap-operated drop sash. Air-operated window wipers are provided on the center and right front cab windows. The sliding doors in the mail and baggage compartments are provided with flush-closing guides.

The Engine and Power Transmission

The power plant consists of a 660-hp. Alco type McIntosh & Seymour Diesel engine, having six cylinders enblock, directly connected to a Westinghouse generator set. The engine operates on the four-cycle principle and has a normal sea-level rating of 660 hp. at 740 r.p.m.

Underframe at the front end of the power car

and an idling speed of 350 r.p.m. The cylinders are 12½ in. bore by 13 in. stroke.

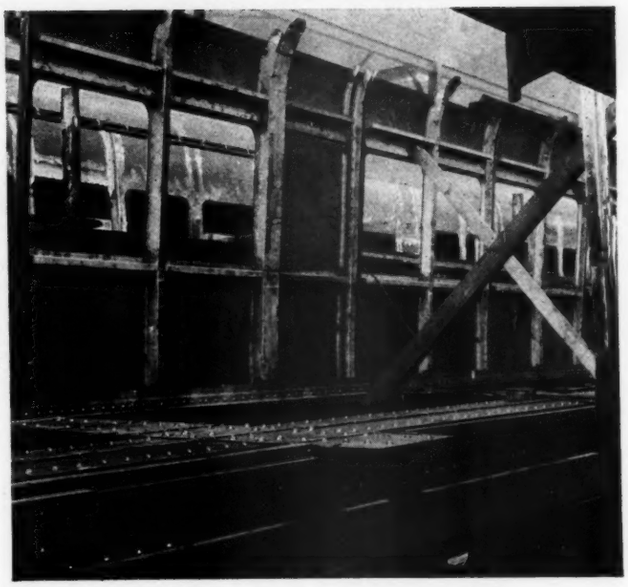
The cylinder block is in one piece made up entirely of welded rolled-steel sections. The cylinder base is also of one piece made of the same welded construction. The welding was done at the Dunkirk Works of the American Locomotive Company. An engine of this welded construction has been in locomotive service for more than two years and has given satisfactory service. The engine, including circulating pumps, weighs 24,500 lb., or 37.1 lb. per hp., a reduction of more than 20 lb. per hp. from the weight of the engines built for switching locomotive service with cast cylinder block and base.

Close-grained cast-iron cylinder liners are fitted in the cylinder block and, like the bearings, may be renewed periodically after an anticipated service of 5 to 10 years. The cylinder heads are separate castings of semi-steel, one for each cylinder and each head contains two intake and two exhaust valves, as well as the fuel-injection nozzle, all arranged symmetrically. The valve operating gear is entirely enclosed and pressure lubricated.

A heavy crank shaft is mounted in seven 9½-in. by 5½-in. main bearings in the engine base. The aluminum pistons are of the trunk type with cast-iron rings and the connecting rods, steel forgings. The engine base is extended to provide a base to which the generator frame is bolted. Access to the running parts in the base is provided by large detachable covers on both sides of the engine. Fuel is pumped from the 600-gal. fuel-oil reservoir by a small motor-driven pump to the injection-pump unit mounted on the side of the engine. This injection pump unit contains six individual pumps, one for each cylinder.

A lubricating-oil reservoir is located in the engine base below the floor and all bearings and moving parts are lubricated under pressure by a power-driven oil pump located in the bottom of the base on the front end of the engine.

The Diesel engine drives three Westinghouse electrical generators. The generator assembly, which consists of the main generator, the auxiliary generator and the control generator, weighs 10,520 lb. The main generator, which is rated 450 kw. at 740 r.p.m., provides power for propelling the car and is also used for starting the engine. The auxiliary generator, the stator of which is overhung at the rear of the main generator, is rated at



Installing the side sheets on the car

60 kw. and develops power at 130 volts d.c. for the air compressor, radiator fans, air conditioning, generator excitation, lighting, cooking and battery charging throughout the train. The output of the control generator is used for operating the engine loading-control apparatus. A fan is mounted on the Diesel-engine flywheel which forces ventilating air through the generator assembly.

The auxiliary generator is compound-wound and is separately excited from the storage battery. The voltage output of this machine is held at 130 volts, under the varying auxiliary load conditions, by a vibrating-type voltage regulator, over a range of speeds from 350 to 740 r.p.m. The auxiliary power is distributed throughout the train by bus lines run in conduit under the car floors. The O-B Tight-Lock couplers have electrical contacts for these bus lines and also for control and signal circuits.

Two Westinghouse 275-hp. traction motors are used to propel the train. They are of the self-ventilated series type and weigh 6,400 lb. each. They are mounted

Side sections ready for installation on the cars

Looking forward in the engine room

on the rear truck of the power car. The motors are suspended between the axle and the truck transom, one motor being used to drive each axle; the gear ratio is 22 to 54. The armature is carried on roller bearings and the axle bearings are of the sleeve type. They are connected to the generator either at series or parallel, at the will of the operator, by a small selector controller combined with the engine-starting controller. The motor is shunted at high train speeds by the same controller.

The engine-loading system used is the Westinghouse torque control, which is designed to absorb the full output of the engine over a wide range of train speeds. Any one of six engine-operating speeds may be selected by the master controller and maintained by the engine-governor operator. At each of these speeds, the circuit of the loading relay is automatically adjusted to control the main generator excitation so as to absorb all the engine horsepower available at this speed.

The oil and water cooling radiators for the engine are ventilated by two 40-in. propellor fans, each driven by a Westinghouse 10-hp. 130-volt vertical motor. These motors are mounted above the generator assembly, and each fan is mounted directly on the upper end of the motor shaft. The air compressor for the brake supply is driven by a 35-hp. series motor.

The Trucks

The trucks are of the conventional equalizer type with cast-steel side frames and bolsters. The side-frame castings for the power car are of Lebanon Circle L2 alloy steel, heat treated. Those for the passenger-carrying cars are similar in design, but because of the lighter loads are carbon-steel castings.

The complete truck frames are built-up with separate transoms and end sills. Except in the case of the motor truck the transoms are built up of plates and angles riveted to horizontal arms cast integral with the side frames. The end frames are 6-in., 12-lb. ship channels.

The motor-truck transoms are alloy-steel castings similar to the side frames and are designed to include the spring nose suspension for the traction motors.

Both trucks under the power car are fitted with 36-in. rolled steel wheels mounted on 6-in. by 11-in. axles, fitted with Timken roller bearings, and have a wheel base of 8 ft. The motor truck, which weighs, complete including the motors, 30,400 lb., is mounted under the rear end of the car, while the idling truck, which weighs 16,300 lb., is mounted under the engine at the front end of the car, thus improving the equalization of the load at the rail under the two ends of this car.

The trucks under the passenger-carrying cars have a wheel base of 7 ft. and are carried on 4½-in. by 8-in. axles having Timken roller-bearing journal boxes and 33-in. rolled-steel wheels. Each weighs 12,000 lb. Oilite discs are applied on the center plates of all trucks and Miner safety bolster locking center pins are used throughout. The trucks under the passenger-carrying cars are liberally supplied with insulation against the transmission of noise to the car interiors. Felt pads are applied under and around the sides of the center plates, under the side bearings and under the bolster end and side wearing plates. Molded rubber discs are placed at the top and bottom of the equalizer springs and felt pads are placed between the equalizer seats and the journal boxes. In the power-car trucks the only sound insulation are felt inserts placed between the ends of the equalizers and the journal boxes. All of the trucks are equipped with Simplex unit-cylinder clasp brakes.

Air Brakes

The trains are equipped with the New York Air Brake Company type HSC brake with Decelakron control of the braking ratio during emergency applications. This is an electro-pneumatic brake for use in high-speed service and is adaptable to multi-unit trains of any length. The brake valve is self lapping. It includes the "dead-man" safety feature and an interlocking relay automatically opens the traction-motor switches and idles the engine when an emergency brake application is made. Automatic sanding control is also provided in emergency. There are two brake pipes, one for straight air and one for automatic operation. Control of the brakes interchangeably with standard steam equipment is thus provided for.

The braking ratios specified are 169 per cent for the front truck of the power car, 197 per cent for the motor truck, 200 per cent for the trucks under all of the coaches, and 185 per cent for the front and 165 per cent for the rear trucks of the sleeper-observation car. All of the cars are equipped with Universal ratchet hand brakes with drop handles operating through the Peacock gear train. These brakes operate only on a single truck of each car.

Air Conditioning System

The passenger-carrying cars are supplied with the A. C. F. system of air conditioning. This includes a motor-driven York six-ton Freon compressor, driven by a Century dual motor, and an A. C. F. fan-cooled condenser unit, both units being mounted under the car. The compressor motor consists of a 7½-hp. 115-volt d.c. motor and a 10-hp. three-phase 220-volt a.c. motor. Normally the compressor is driven by the d.c. unit. At terminals, however, 220-volt power may be used to operate the 10-hp. motor. The d.c. motor then acts as a generator and provides power for charging the batteries.

Separate evaporator units are installed for each compartment in each car. In each of the coaches that which serves the compartments for white passengers is installed above the saloon passageway ceiling, while the one which serves the colored passenger compartment is placed above the vestibule ceiling. Each contains a double blower driven by a Century ⅓-hp. motor mounted between the evaporator and the beginning of the ceiling duct, with which the blower housings are directly connected. The fresh air is admitted through louvres near the bottom of the vestibule side doors and passes to the two evaporator units through grilles in the vestibule ceiling. Above those for the white passenger compartments are placed 2-in. metallic-wool filters.

The recirculated air in the white passenger compartment is admitted to the unit through a grille in the saloon passageway ceiling, while that from the colored passenger compartment passes through a grille in the vestibule bulkhead. The recirculating grille in the white passenger compartment carries a 1-in. filter of metallic wool.

In the air-conditioning equipment of the observation-sleeping car are a number of unique developments. The evaporator unit for the sleeping compartment is mounted at the end of the car over the passageway ceiling. The cooled or heated air from the unit is delivered to the sleeping compartment through the central ceiling duct and through grilles in the ceilings of the stateroom and the two dressing rooms. To insure thorough ventilation of the lower berths at night this portion of the car is equipped with two return air ducts placed one along each side of the fresh-air duct above the ceiling. These ducts, in each of which propeller-type fans driven by ⅙-hp. Arovent motors are mounted over the ceiling of the ladies' dressing room, are connected by branch ducts passing down through the permanent bulkheads between the berth sections, each of which opens into a section through a grille which is behind the headrest cushion when the berths are not made up. Another duct in each bulkhead leads from the bottom of the bulkhead just above the floor to a grille opening on the opposite side of the bulkhead from that connected with the suction duct. Thus, at night when the berths are made up, air is steadily exhausted from each berth through the return-air ducts and fresh air supplied from near the floor through a grille at the opposite end of the section.

The return-air ducts are provided with slotted openings along the sides similar to those in the fresh-air ducts which tend to provide similar positive ventilation for the upper berths. Manually controlled dampers in the return-air ducts permit all return air to be wasted through grilles in the end of the car or to be recirculated through the evaporator units, or a part to be recirculated and a part wasted. Fresh air for the sleeping compartment is taken from underneath the car through a duct which occupies a corner in the ladies' dressing room. A recirculating grille in the passageway ceiling under the evaporator unit draws air from the corridor by the stateroom and ladies' dressing room.

Garland suction type ventilators are provided in the ceilings of the toilet rooms. Louvres in the doors to these rooms provide for a direct exhaust of smoke-laden air from the dressing rooms, thus keeping it from recirculating into the body of the car.

The evaporator unit for the observation compartment is mounted over the vestibule ceiling and receives its fresh air through a filter-protected grille in the ceiling. The fresh air is admitted and distributed in the observation compartment through a Hart & Cooley grille in the bulkhead at the rear of the luggage-rack passageway. The recirculated air returns to the evaporator unit through filter-protected grilles at the top of the luggage-racks.

Unusual care has been devoted to providing ready accessibility to the evaporator units and accessory equipment mounted over the ceilings. This is done through the hinged grilles and through hinged panels in the ceilings, above which the motors and blowers are mounted on hinged plates which permit them to be dropped down through the ceiling openings where they can be readily worked upon without detachment and removal.

Car Heating

The cars are heated by the Vapor system with steam supplied from a Peter Smith automatically oil-fired boiler with a capacity of 500 lb. per hour. No attempt has been made on these cars to provide for reclamation of the condensate and two 300-gal. water tanks in the front end of the baggage car provide feedwater for the boiler.

Each car is equipped with a new Vapor constant-pressure regulator. This includes a pressure reducing function, in addition to the usual regulator, which reduces train-line pressure to a maximum of 30 lb. per sq. in. at the regulator. The latter is thus never called upon to handle a greater pressure differential than 30 lb. per sq. in.

The power truck

Heat is supplied to the passenger coaches from two sources—the fin heating coil in the air-conditioning unit and the fin-pipe radiators at the base of the side walls. The heat is controlled automatically through magnet valves which are electrically actuated through thermostats. The floor radiator consists of a single 1¼-in. fin pipe with a 1¼-in. standard return pipe along each side of each compartment. These pipes are enclosed in a rectangular duct which also serves as a support for the ends of the seats and through openings in the side of which the heat is admitted to the car body by air circulation.

Lighting

A combination of direct and indirect lighting is used in the coaches. There is an indirect lighting duct on either side of the air-distribution duct containing 10-watt lamps spaced about 12 in. apart. This lighting is supplemented by Spotray lighting fixtures in each pier panel, immediately above the curtain-box molding and between the baggage racks. These units are mounted at an angle to project a cone of light downward and outward on the reading plane in each seat. Each unit contains a 25-watt lamp and is controlled by an individual toggle switch. The lighting units in the men's and women's rooms are recessed into the ceilings, and the lighted surface is a flat plane of diffusing glass flush with the ceiling.

Air-conditioning fans and motor dropped for servicing

The observation-lounge is lighted by a special oval semi-indirect lighting fixture, in the center of the ceiling, which contains seven 50-watt lamps. Additional illumination is supplied by six pier-panel fixtures, each containing two 25-watt lamps, and by two table lamps, each of which is fitted with two 25-watt lamps.

The lighting for the sleeping compartment is furnished by three center ceiling fixtures, each containing five 15-watt lamps, and by individual 15-watt Spotray berth fixtures.

Two Pyle-National headlights are used. One is a 150-watt vertical-beam headlight and the other a 250-watt horizontal-beam headlight. The 50-watt classification lamps are located immediately above the windows in the front end of the power car and arranged to indicate green or white. There is a Golden Glow back-up light at the rear end of the observation car. It is controlled from a back-up locker in the form of a small table at the rear of the observation lounge. This locker also contains a back-up valve and a conductor's signal button.

The full-width diaphragm and the O. B. Tight-Lock coupler with its connectors

Exide Ironclad storage batteries are installed in the power cars, in the sleeping-observation cars and in the swing coach. The power-car battery is a type MVAHT, with 54 cells, and has a rated capacity of 262.5 amp. hr. It is used for lighting the power car and the buffet-coach when the engine is not running, and also for engine starting and power control. The batteries for the other two cars are each 54-cell type KXK-9 of 75 amp. hr. capacity. All batteries are connected in multiple when the train is made up and are charged from the auxiliary generator. Connections are such that the air-conditioning compressor motors cannot be operated unless the auxiliary generator is in operation.

Couplers and Other Equipment

The cars of these trains are equipped with O-B Tight-Lock couplers with A. A. R. standard contours, which permit coupling with A. A. R. standard couplers. The coupler stems are arranged to house Edgewater ring-spring draft gears, which operate in an oil bath. The couplers are attached to the underframe through a ball-joint mounting which provides for the universal movement made necessary by the lack of movement between adjoining couplers due to the Tight-Lock feature.

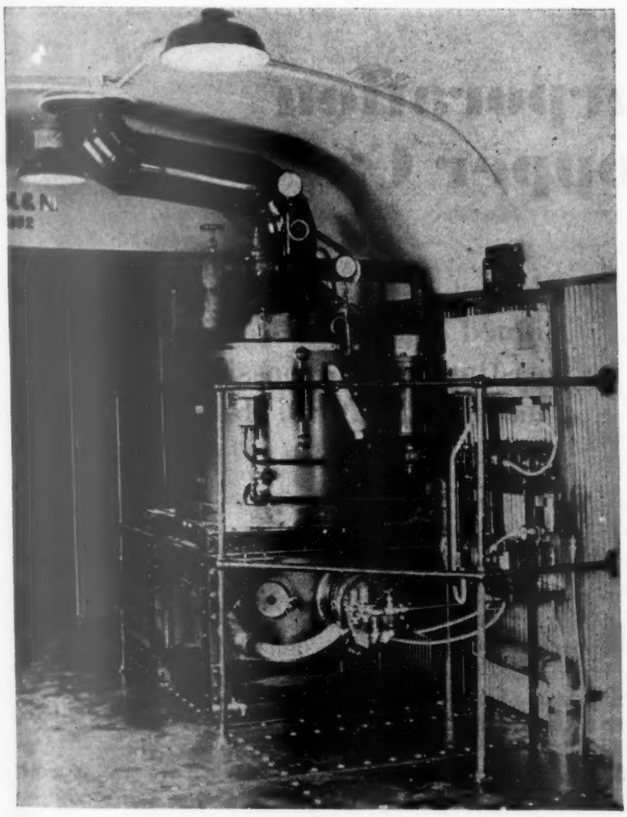
Each coupler carries a connector head which contains two side ports for the steam train line and a single central port each for the automatic and the straight-air

brake pipes. The steam and air ports are both protected by automatic check valves. Flexible pipe connections with Vapor ball joints are provided for the connector steam ports. The air connections are armored hose.

Below the pipe connections are arranged electrical connector contacts for the auxiliary power and lighting train lines, as well as for the buzzer cab-signal and air-brake-operating circuits. Back of the couplers is a switch-box for controlling the electric brake circuits leading to the connector head. The switch, which is opened before cars are uncoupled, is controlled by a shaft which extends across the car with handles on either end which are readily accessible from the sides of the car. The movement of either of these handles also operates stop cocks in both brake pipes.

Arrangements are made for the mounting of portable couplers at the front of the power car and the rear end of the observation-sleeper. Cut-out cocks and connections for air-brake hose are also provided at both of these locations.

The power car is equipped with Graham-White sanders delivering to the front wheels of both power-car



The heating-boiler installation

trucks. A Pneuphonic horn and a locomotive type bell, with King type pneumatic ringer, are mounted below the engine-room floor directly behind the pilot. The trains are equipped with G. R. S. intermittent type automatic train control.

The trains are striking in exterior appearance, partly because of the smooth, unbroken lines of the car structures and partly because of the use of color. A broad band of Chinese red extends from 3 in. below to 2 in. above the windows and is unbroken from the front to the rear end of the train. The roofs and the remainder of the sides are of aluminum color, except for a band of gray 11 in. wide covering the inwardly curved skirting at the bottom. The lettering is in red outlined in black and narrow stripes of black are used to separate the body colors where they join, as well as to outline the top of the letterboard space. The name of the train appears in aluminum outlined in black on the broad red band at the sides of the power car. The sides and roof of the monitor are in red and an emblem of conventionalized wings on the front below the windows is also in red with black lines and across it are the initials of the road in polished chromium. The exterior finish is done in Duco lacquer.

The interior finish, for which Dulux was used, consists of ivory ceilings. The coaches have two shades of wall finish. The darker shade is used below the window sills and is repeated in the polished-aluminum curtain-box molding above the windows and in the trim between the ceiling and side-wall color above the individual luggage racks. In the buffet coach the wall colors are two tones of pastel green, with Massachusetts Mohair henna plush upholstery in the white passenger compartment and red embossed antique leather in the colored passenger compartment. The sides and walls of the swing coach are in cream and mocha, with green Shelton-Looms plush upholstery in both passenger compartments. In the sleeper-observation car the wall colors in the sections are pastel gray and gray-green, with purple-gray (slate) colored Chase plush upholstery in a broken-stripe pattern and a carpet of egg-plant and gray in a figured basket-weave pattern. The stateroom walls are in ivory and mocha with tan upholstery on the transverse sofa, blue on the lone seat which faces the main sofa, and a plain rose taupe carpet. The observation room has chairs of three types which are finished in three contrasting selections of upholstery. The walls are of sand and mocha and the carpet has a tan ground with a broken-stripe figure in black.

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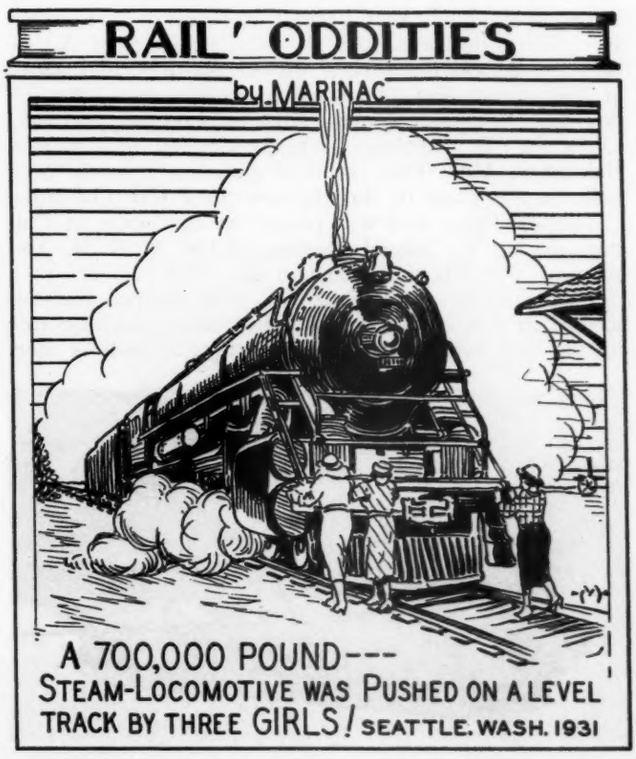


Further explanation furnished by the editor upon request

Rustless Iron Corporation Light-Weight Hopper Car

High-tensile alloy sheets combined with light-section steel castings make possible a car having 135,900 lb. revenue-load capacity with a light weight of 33,100 lb.

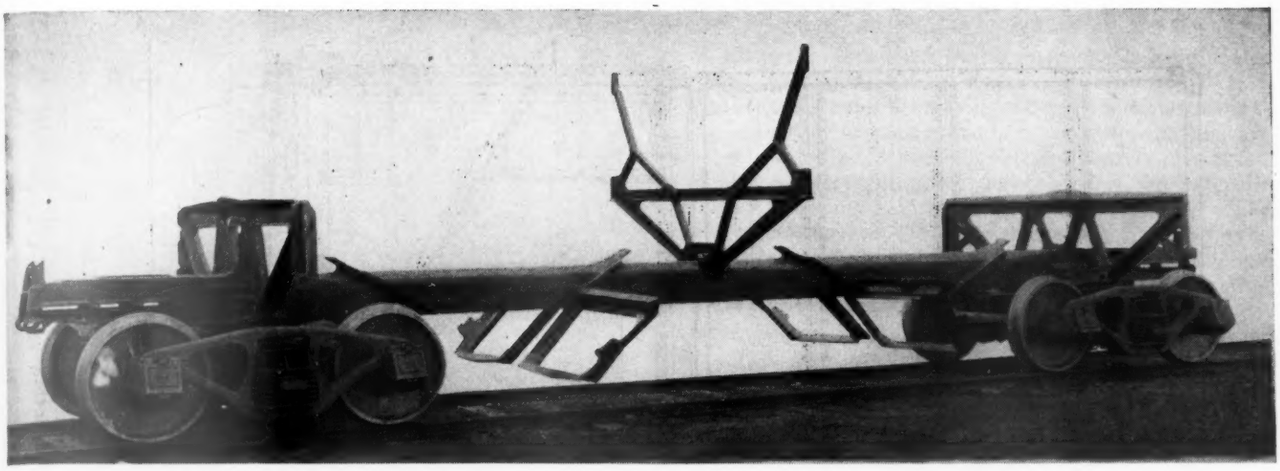
ALTHOUGH the ultimate life of a hopper car is generally regarded as being limited by the life of its underframe, corrosion in cars used for the transportation of coal, particularly of high sulphur content, has so destructive an effect on such car parts as slope sheets, hoppers, crossbearers, center ridges and the lower side sheets that periodical renewals are necessary, with consequent excessive maintenance costs. A hopper car, embodying several unique features, and aimed at the elimination of excessive maintenance charges, has been designed by The Unitcast Company, Toledo, Ohio, for the Rustless Iron Corporation of America, Baltimore, Md. One of these cars has recently been built at the plant of the Ralston Steel Car Company, Columbus, Ohio, and was placed on exhibition at Chicago during the annual meeting of the A. A. R. Mechanical Division, June 26 and 27, 1935.

The purpose in building the twin hopper car described in this article was to demonstrate the economic justification for the use of high-strength rustless steel in lighter than conventional gages in the construction of hopper-car bodies which are subjected to severe corrosive influences. The design aimed at a high ratio of revenue load to total weight without sacrifice of any of the structural strength of the conventional car. The car which has been constructed has a total light weight of 33,100 lb. and a maximum revenue load of 135,900 lb., providing a revenue load to total weight percentage of 80.4.

The under side of the car showing the arrangement of the hoppers and doors

New Structural Rustless Steel

The car body, including essential members such as side and slope sheets, hopper sheets, end sheets, and bottom and top angles, is fabricated of RR-11, a new structural rustless steel developed by the Rustless Iron Corporation of America, in co-operation with the American Rolling Mill Company, which produced the sheets and plates. This is a very low carbon stainless steel, containing about eleven per cent of chromium. It is made by patented processes involving the direct reduction of chrome ore, and its improved fabricating qualities are attributed to these special processes, as well as to its composition. The material may be used in either riveted or welded construction, and has a tensile strength



The Unitcast assembly—center sill, cross members and hopper door frames—mounted on the trucks

of from 80,000 to 120,000 lb. per sq. in., varying to meet requirements. Typical physical properties are as follows:

Ultimate tensile strength	90,000 lb. per sq. in.
Yield point	65,000 lb. per sq. in.
Elongation in 2 in.	15 to 25 per cent (dependent on gage)
Hardness	185 Brinell
Izod impact	90 ft.lb.

The cast structural assembly consists of a solid cast-steel center sill with integral center plates to which are attached, by means of riveted joints, the body bolsters, crossbearers, crossbearer arms and hopper frames—all unit castings. The weight of this assembly is 6,850 lb. The cast-steel hopper frames act as additional crossties, increasing the rigidity of the underframe, and carry door-hinge lugs which prevent the doors from getting out of line once they are fitted up in the proper locations. The cast-steel door frames are designed to insure against loss of lading through the doors by reason of the fact that the weaving of the car is said not to change the door fits. The hopper openings are 24 in. by 38 in. The cast steel members of the car framework were furnished by the Unitcast Company and the Unitcast center sill was cast by the General Steel Castings Corporation.

The Underframe

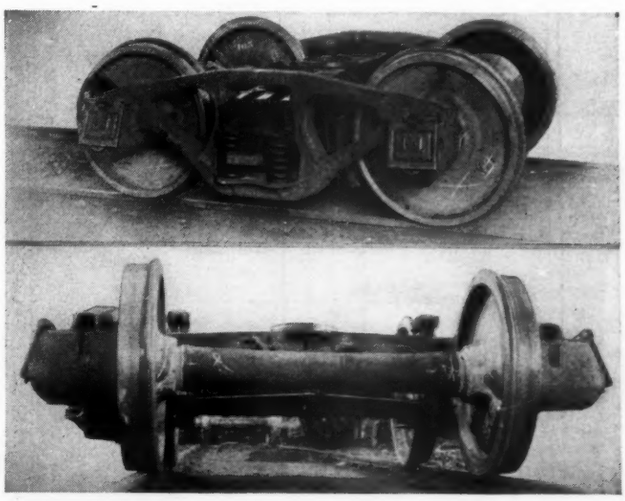
The backbone of this car consists of a Unitcast center sill, a single steel casting extending the full length of the car, which weighs 4,360 lb., is 12 in. wide by 14 in. deep at the center, and has a cross-sectional area of 26.75 sq. in. The ratio of unit stress to end load in the bottom fibers of this center sill is .04. The body bolsters are attached by riveting at the truck-center location, and at the middle of the car the cross-bearers are attached to the center sill in a similar fashion, and the cross-bearer arms, in turn, are riveted to the crossbearers. Midway between the crossbearers and the body-bolster flanges are cast as an integral part of the center sill to which the inner ends of the hopper-door frames are riveted, as well as the cross-ridge and slope sheets. The top and bottom side and end sills and side stakes consist of RR-11 rolled shapes and pressings. The side stakes are on the inside of the side sheets. The RR-11 sheets used in this car are of the following thicknesses:

Sides and ends	5/32 in.
End floor sheets, inside hopper sheets and intermediate Stakes	1/4 in.
Cross-ridge sheets	7/16 in.
Outside hopper sheets	1/4 in. and 5/16 in.
Hopper doors	5/32 in.
Floor stiffeners	9/32 in. and 5/16 in.
End stiffeners	5/16 in.
Bolster stakes, crossbearer stakes, corner posts, diagonal braces, side sills, end sills and coping section	3/4 in.

Liberal use was made of stiffening members, there being 16 intermediate side stakes of the conventional U-shape, four between each bolster and crossbearer.

Principal Dimensions and Characteristics

Length over striking faces	35 ft. 10½ in.
Length, coupled	38 ft. 8½ in.
Length inside	35 ft. 0 in.
Width inside	10 ft. 4¼ in.
Length, center to center of trucks	26 ft. 0 in.
Height, top of side above rail	10 ft. 8 in.
Total light weight of car	33,100 lb.
Total loaded weight (maximum)	169,000 lb.
Maximum revenue load	135,900 lb.
Per cent, revenue load to total loaded weight	80.4
Load density to give full axle load, lb. per cu.ft.	52.47
Weight of plates in car	4,400 lb.
Weight of shapes and pressings	3,650 lb.
Weight of bars and forgings	1,100 lb.
Weight of Unitcast underframe complete	6,850 lb.
Weight of couplers, yokes and draft gear	2,300 lb.
Weight of air brakes, specialties and miscellaneous parts	1,520 lb.
Weight of two trucks, complete	13,280 lb.
Cubic capacity, level full	2,278 cu.ft.
Cubic capacity, with heap	2,590 cu.ft.

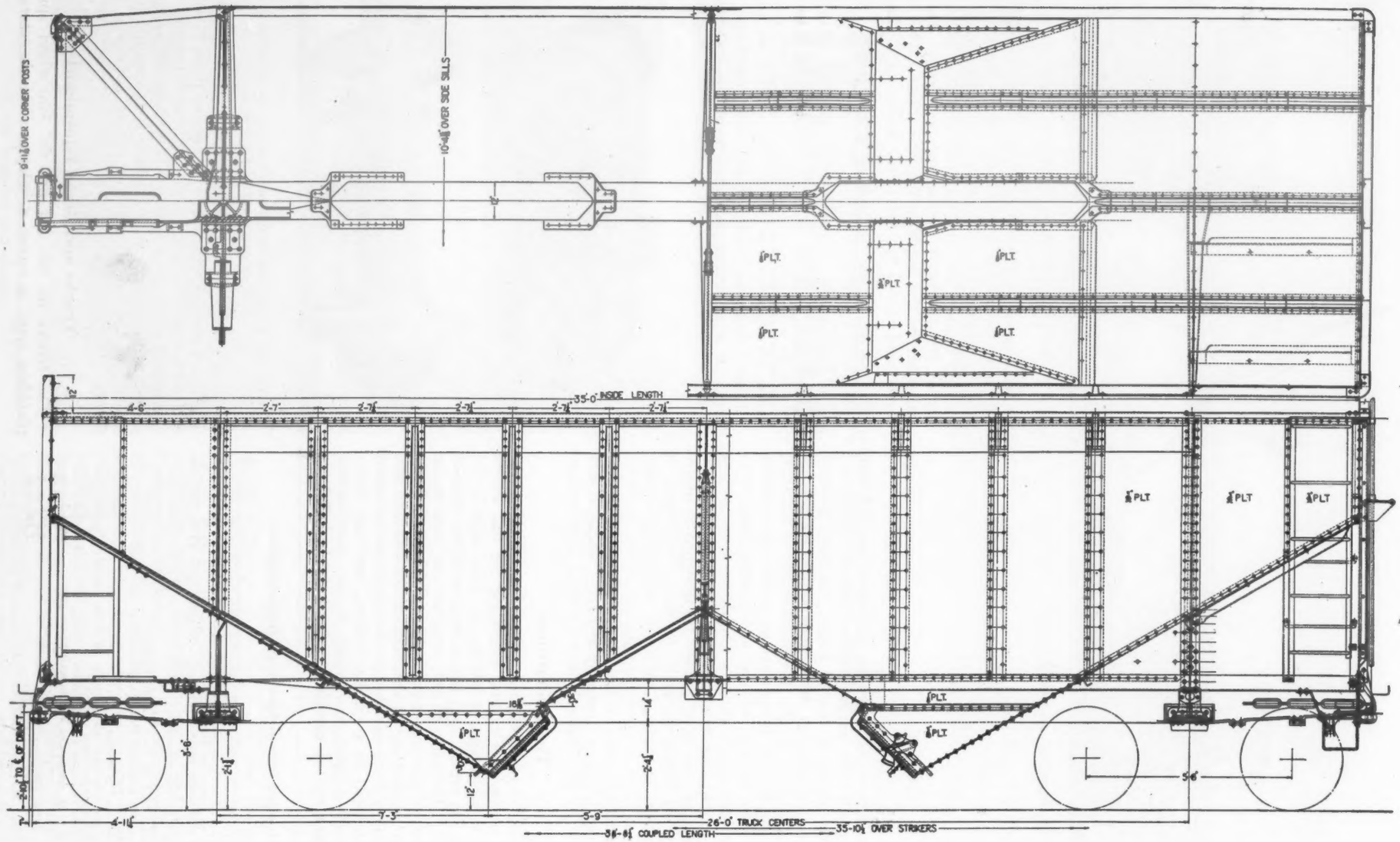


The spring plankless truck with alloy steel side frames and bolster weighs 6,640 lb.

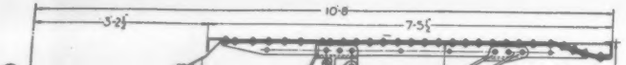
The floors are strengthened by the use of three U-shaped stiffeners extending longitudinally through the end floor sheets and cross-ridge sheets. The center sill is so designed as to be self-clearing where it is exposed to the interior of the car without the use of additional hood sheets.

Trucks and Brake Equipment

The trucks on this car are the four-wheel spring-plankless type, a recent development of the cast-steel



Side elevation and plan of the light-weight hopper car built for the Rustless Iron Corporation of America



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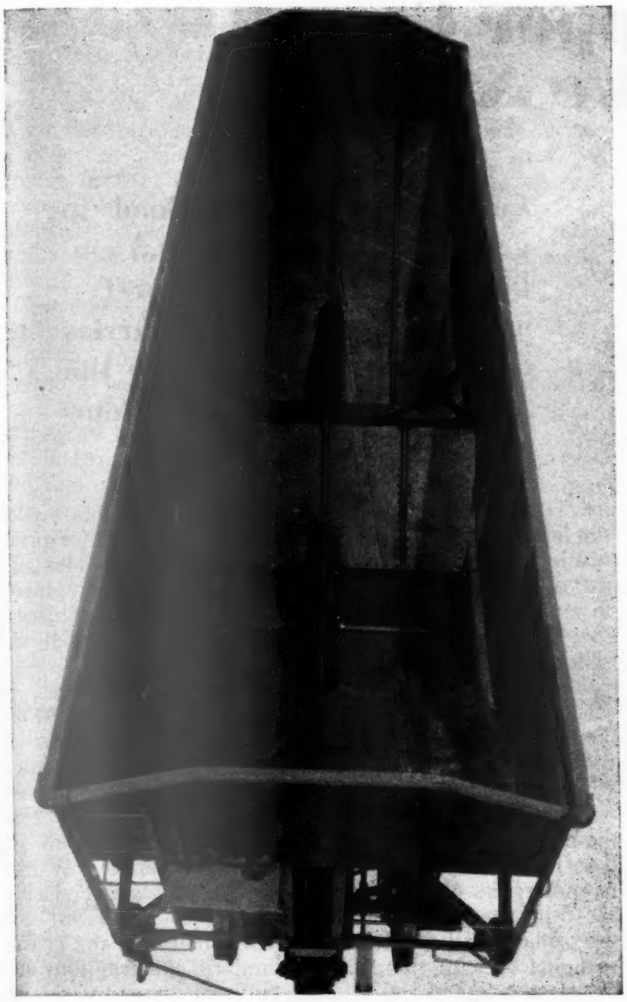
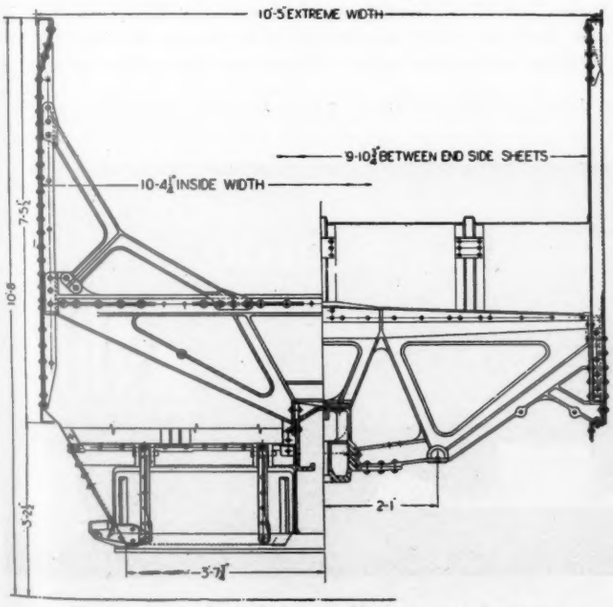


The interior of the car showing the side stakes, cross ridge and center ridge

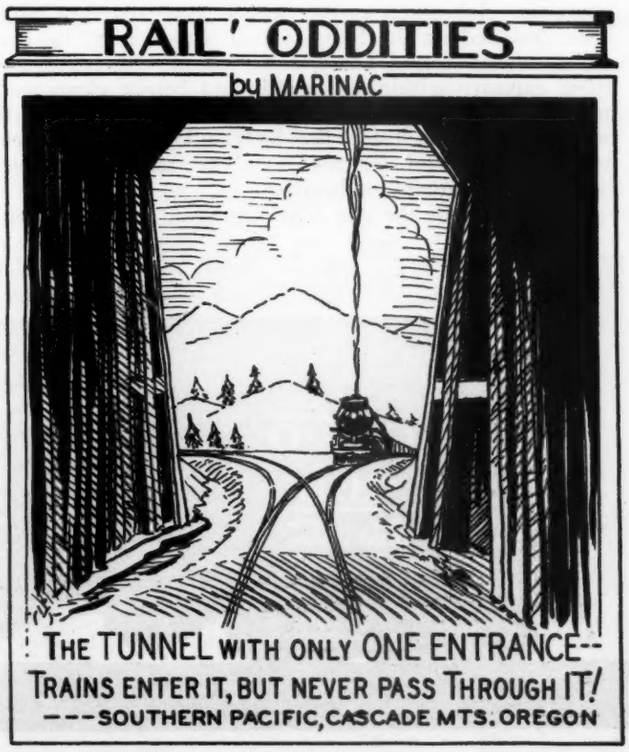
truck manufacturers. They have open-hearth steel axles with 5½-in. by 10-in. journals spaced on 5-ft. 6-in. truck-wheel centers. The two trucks are 26 ft. from center to center. One-wear wrought-steel wheels, 33 in. in diameter, furnished by the Armco Railroad Sales Company, are used.



Cross-sections at the crossbearer and bolster

These trucks have been designed with a view to maximum reduction in weight and, to accomplish this, are equipped with the spring-plankless type, double-truss, self-aligning side frames of light section, high tensile cast steel, meeting A.A.R. HT 35 specifications. The truck bolsters are of the same material. The engaging surfaces between bolster and side-frame columns are shaped cylindrically and terminate in radial guiding steps so that, in the absence of the spring-plank, engagement between the bolster and the side frame is maintained with large, uniform bearing contacts. A bracket cast integral with the side frame provides for the attachment of brake-beam safety devices. The bolsters and the side frames were furnished, respectively, by the Buckeye Steel Castings Company and the American Steel Foundries. The truck springs are the non-harmonic Coil-Elliptic type supplied by the American Locomotive Company, Railway Steel Spring Division. Wine side bearings are used. Open-hearth-steel brake levers, hangers and bottom connectors form a part of the truck brake rigging. Hangers and retainers were supplied by the Schaeffer Equipment Company. The brake equipment on the car is the Westinghouse Air Brake Company automatic empty-and-load equipment, and the brake beams on the trucks are A. A. R. standard No. 3, a high capacity beam suitable for use with the empty and load brake. The Wine Railway Appliance Company brake balancer is used in connection with this equipment. The car is fitted with Ajax hand-brake mechanism.

In the coupler and draft-gear arrangement high-tensile light-weight couplers and yokes have been used. The draft gear is the Waugh-Gould type with selective-travel attachments. The yokes were supplied by the Buckeye Steel Castings Company and the coupler assembly, of A. A. R. swivel-butt type, was furnished by the National Malleable and Steel Castings Company, with butts manufactured by the Gould Coupler Company.



Further explanation furnished by the editor upon request

Light-Weight Hopper Car for the Chesapeake & Ohio

Car having revenue load to gross weight ratio of 79.5 embodies extensive use of Cor-Ten and Man-Ten Steels and carries 67 tons of coal—Built by the American Car & Foundry Company

A NEW design of light-weight, heavy-duty hopper car, built for the Chesapeake & Ohio by the American Car & Foundry Company, was exhibited at Chicago in connection with the annual meeting of the Mechanical Division of the Association of American Railroads. Features have been incorporated in this car which have never before been used in freight cars for general interchange service. This car is one of a lot of 10 built largely of high-tensile, Cor-Ten and Man-Ten steels. The railroad intends to put these cars into regular service, to obtain definite data as to the relative performance of cars built of these materials compared with cars of ordinary low-carbon or copper-bearing steel.

In preparing the design three objectives were given special attention: First, to adapt the equipment to the particular conditions and requirements of service on the Chesapeake & Ohio; second, to afford an opportunity for tests, under actual service conditions, of new materials and appliances; and, third, to include the latest developments and standards in those features which are not of special construction.

These cars, mounted on 5½-in. by 10-in. trucks, have been made to carry 67 tons of coal, the light weight being 34,600 lb. and the load limit 134,400 lb. The reduction in weight, compared with the last previous Chesapeake & Ohio hopper car, is approximately 4 tons and, compared with the estimated weight of the proposed A.A.R. standard hopper car, approximately 3½ tons. The ratio of revenue load to gross weight is 79.5 per cent.

The weight of a large proportion of the coal carried by the Chesapeake & Ohio is approximately 54 lb. per cu.ft. Inasmuch as the A.A.R. standard cars have been designed on the basis of coal weighing 52 lb. per cu.ft., it was found possible to provide the necessary cubic capacity within the width and height clearances adopted for the A.A.R. standard car with a length of only 33 ft. 6 in. inside the body. The use of three hoppers was found desirable to obtain maximum cubic capacity with minimum length.

In the body of the car USS Cor-Ten steel has been used in general for all parts which come in contact with the lading. USS Man-Ten steel has been used for practically all body shapes with which the load does not make contact and low-carbon structural steel employed in those members where it was not considered necessary to provide either high strength or increased resistance to corrosion.

The three-hopper car body which, at the sides, is 10 ft. 8 in. above the rail, has a top bulb angle of Man-Ten of 5-in. by 2½-in. 8.5 lb. section. The ends, of the Dreadnought type, curve upward toward the center where the height is 11 ft. 9¼ in. The end is reinforced with a 5-in. by 3-in. by ¼-in. angle of Man-Ten. For the side stakes 5-in. by 2½-in. 7.3 bulb angles of Cor-Ten are used, as this section necessitates only one row of rivets at each post. The side sills and end sills are 5-in. by 3½-in. by ¼-in. angles of Man-Ten. In the center sill the railroad desired to maintain the cross-sectional area of the A.A.R. standard construction and therefore adopted the Z 26 section of structural grade carbon steel for this member.

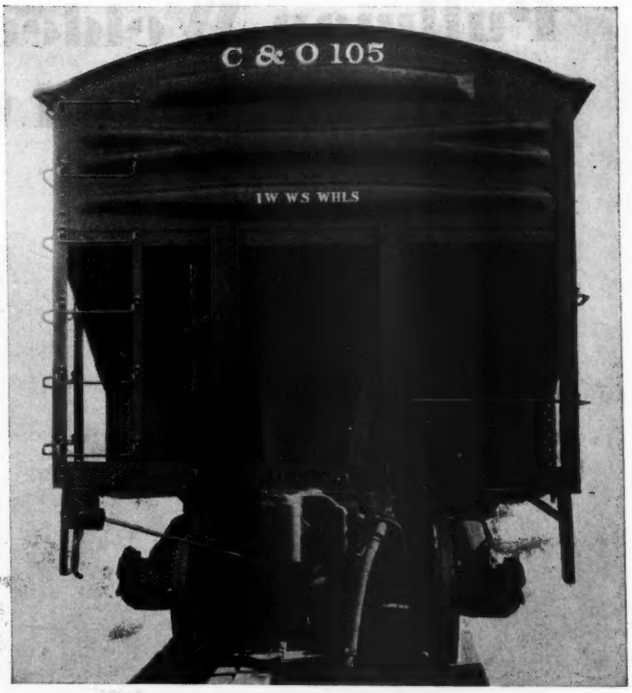
The body bolsters are built up of Man-Ten with 3/16-in. web plates, 5/16-in. bottom cover plates, 5-in. by 3½-in. by ¼-in. bottom angles and 3½-in. by 3-in. by ¼-in. vertical stiffening angles. Substantial stiffening for the body is provided at the cross-ridges by 3/16-in. cross-ridge plates and cross-ridge and side-stiffeners formed from Cor-Ten sheets, punched out for lightness, which are bent at their upper edges to form an oval cross-section, with the edge riveted to the plate where it

Chesapeake & Ohio light-weight hopper car designed to carry 67 tons of coal

overlaps. The body side sheets are 1/8-in. thick and slope sheets, hopper sheets and cross-ridge sheets 3/16-in.—all of Cor-Ten. The main side sheets extend in one piece from the bolster to the center of the car where they are lapped and riveted to the side stake. In order to maintain the proper slopes on all three hoppers without lengthening the body, special construction has been used at one of the cross-ridges. The cross-ridge sheet is extended vertically above the center hopper slope sheet, thus permitting the adjoining hopper sheet to be placed at the proper angle for self-clearing.

The end slope sheet is stiffened between the body bolster and the end of the car by a 3-in. by 2½-in. by ¼-in. angle supported by 3-in. by 3-in. by ¼-in. angles. The hopper doors are of pressed construction made by the Union Metal Products Company and are formed so as to overlap the hopper sheets and are also dished to provide an increase in the cubic capacity. The doors are secured by Wine hopper door locks.

In general, the body is of riveted construction. However, a small amount of fusion welding has been used for joining members around the cross-ridges. Continuous welding is used for joining the top flanges of the Z center sills. The body rivets which come in contact with the load are Cor-Ten and all others low-carbon steel. The bolster center filler is similar to that designed for the new A.A.R. hopper cars. The total weight of the body is 21,260 lb.



End view of the car

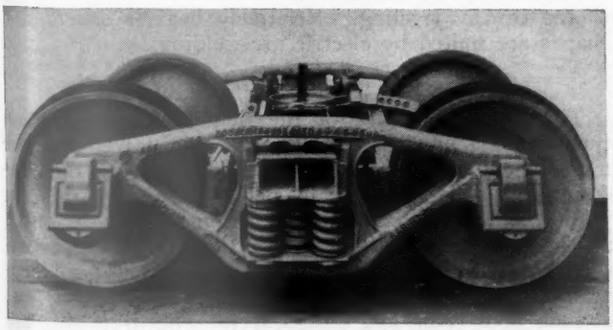
Brake Equipment and Trucks

To provide adequate braking for the loaded car on heavy grades and to reduce the variation in the rate of retardation on the car when loaded and empty, these cars have been equipped with automatic empty and load brakes, having two brake cylinders. The braking ratio is 60 per cent on the light car and 30 per cent when the car is fully loaded. Five cars have brakes constructed by the Westinghouse Air Brake Company and five by the New York Air Brake Company in which the operation of the second cylinder is controlled automatically in accordance with the deflection of the truck springs. The hand-brakes are the Ajax geared type.

The cars are equipped with the new spring-plankless truck. The spring plank was retained at one end for the purpose of operating the automatic change-over device. In the spring-plankless truck, a recent development of the cast-steel-truck manufacturers, the engaging surfaces between the bolster and the side-frame columns are shaped cylindrically and terminate in radially disposed guiding stops so that in the absence of the spring plank engagement between the bolster and the side frame is maintained with large uniform bearing contacts. The truck bolsters have integral center plates and are designed for the new A. A. R. center-plate height of 25¾ in. A bracket cast integral with the side frame provides for the attachment of the brake-beam supports. The side frames are of the integral journal-box type and the truck wheel base is 5 ft. 6 in. The bolsters and side frames are of high-tensile cast steel meeting A. A. R. HT-35 specifications, and were furnished, respectively, by the Buckeye Steel Castings Company, and the American Steel Foundries. The wheels are the one-wear type of rolled steel, mounted on standard axles. The brake beams are A. A. R. No. 3 capacity of high tensile steel with heat-treated cast-steel brake heads. Creco four-point brake-beam supports are applied on all cars. One Cardwell snubber is applied with each group of A. A. R. Type D truck springs.

The railroad has applied to these cars two sets of each of the following draft gears: Waugh—No. 403, Miner—No. A-22-XB, Cardwell Westinghouse—No. NY-11-E, Edgewater—No. B-32-KA and National—No. M-17-A.

Prior to the introduction of high-tensile steels it has not been possible for the railroads to effect substantial reductions in weight and still retain the strength required for heavy freight service. The Chesapeake & Ohio has been alert to the possibilities of reducing operating costs by lighter equipment and has built these cars with a view to determining from experience obtained in regular service the over-all economies that may be obtained by the introduction of light-weight equipment designed for heavy-duty service.



One of the spring-plankless type light-weight trucks

Principal Dimensions of Chesapeake & Ohio Light Weight Hopper Car

Length over striking plates	34 ft. 5¾ in.
Length inside	33 ft. 6 in.
Width inside	10 ft. 4 in.
Width overall	10 ft. 5 in.
Height, rail to top of sides	10 ft. 8 in.
Distance between truck centers	24 ft. 6 in.
Truck journals	5½ in. by 10 in.
Truck wheel base	5 ft. 6 in.
Light weight	34,600 lb.
Car body	21,260 lb.
Trucks	13,340 lb.
Load limit	134,400 lb.
Capacity, level full	2,258 cu. ft.
Capacity, 10-in. heap	2,525 cu. ft.
Ratio revenue load capacity to gross weight	79.5 per cent

Pullman Welded Box Car Built Without Added Cost

Welded Cor-Ten steel box car built by the Pullman-Standard Car Manufacturing Company

Cor-Ten steel welded construction and special alloy-steel trucks accomplish a weight saving of five tons over former conventional designs of similar type cars

THE latest contribution of the Pullman-Standard Car Manufacturing Company to light-weight railway equipment is a 50-ton box car* which meets the full interchange requirements and strength specifications of the Association of American Railroads, but weighs approximately five tons less than the A.A.R. standard box car, owing to the use of welded, Cor-Ten steel, body construction and special alloy-steel trucks. Referring to the table of comparative dimensions, it will be noted that the new car weighs 10,200 lb. less than the Chicago Great Western standard car, built about a year ago, and 11,800 lb. less than a former conventional steel double-sheathed box car. These substantial savings in dead weight are available for increased load-carrying capacity. Unusually large cubic capacity is also provided, as shown in the table, due primarily to the $2\frac{5}{16}$ in. greater inside width, with the same outside dimensions. The most significant fact about the car design is that it permits saving 9,000 lb. of dead weight without any increase in cost over conventional steel construction, and 1,000 lb. more can be saved, if desired, with some additional cost.

The Pullman-Standard light-weight steel-sheathed box car is 44 ft. 6½ in. long over coupler pulling faces, 10 ft. 2½ in. wide over door hasp anchors, and 13 ft. $10\frac{13}{16}$ in. high from the rails to the running boards. The distance between truck centers is 31 ft. and the side door clear openings are 6 ft. wide by 8 ft. $6\frac{1}{16}$ in. high. The car body weighs 20,240 lb. and the trucks 13,960 lb., or a total of 34,200 lb. One reason for this unusually light weight is the extensive use of welding in the car construction which involves an estimated 22-per cent arc-welding, 54-per cent spot-welding and 24-per cent riveting, based on length of seam. Sides and ends, for example, are made of .05-in. and $\frac{3}{32}$-in. Cor-Ten steel sheets, respectively, fabricated on special horizontal jigs by spot-welding, but assembled in the car body by riveting at the corners, because this particular operation can be done cheaper and better by riveting. Similarly, roof sheets are joined to each other and to the carlines by spot-welding, the unit roof being secured to the car by riveting. Relatively heavier sheets and shapes are united by electric arc-welding.

A.A.R. Z-Section Center Sills Used

The center sills are of the new A.A.R. Z-Section type, the use of alloy steel permitting the web and the top flange to be reduced slightly in thickness, thus reducing the weight to 29.2 lb. per ft. The two sills are joined by welding continuously throughout their length at the junction of the two top flanges. The cross-sectional area is 17.2 sq. in. total Six center-sill separators, made of ⅛-in. pressed plate, are located, one at each floor beam and crossbearer. The draft sills are formed by the continuation of the center sills, the

* This car was exhibited at Chicago during the annual meeting of the A.A.R. Mechanical Division, June 26 and 27, 1935.

bolster center fillers, rear draft lugs and striker being built up integral with the center sills by the arc-welding of rolled plates and bars. The end sills are 6-in. by 3½-in. pressed angles, offset at the center of the car downward to the top of the center sill.

Each body bolster consists of four 5/32-in. pans with 21-in. by 5/16-in. top and bottom cover plates extending continuous from side sill to side sill. The bolster is connected to the side sill by a pressed channel. The web of the diaphragm over the side bearings is reinforced with a pressed plate welded between the pan webs and the bolster bottom cover plate. The body center plates consist of drop-forged bowls, conforming to the A.A.R. contour, arc-welded to separate 5/8-in. plates.

Interior showing underframe and superstructure framing and the sheathing

The body side bearings, arc-welded assemblies of rolled bars, are provided with 3-in. by ¼-in. spring steel wear plates.

Each of the four crossbearers per car consists of two ⅛-in. pans having top and bottom cover plates, extending from side sill to center sill, in the case of the former, and from side to side under the center sill, in the case of the latter. The webs of crossbearer diaphragms are stiffened at two points with pressed vertical angles spot-welded in place. The cover plates are secured to the diaphragm and the diaphragm to the center sill and side sill with rivets.

Floor Supports and Floor Construction

The floor beams, of which there are two per car, each consists of two ⅛-in. pans extending from center to side sill and connected to the side sill by thick channel-shaped gussets. Diaphragms are riveted direct to the center sill and side sill. Four diagonal braces per car are pressed from a 10-in. by ⅛-in. plate applied one in each corner of the underframe and extending from the corner of the car to the bolster and the center-sill intersection. These braces are riveted to the end and side sill at the corner and to the bolster at the intersection, being welded to the center sill.

Comparative Box Car Dimensions and Weights

	Pullman-Standard Cor-Ten Steel Box Car	Chicago Great Western A.A.R. Standard Box Car	Former Conventional Steel-Sheathed Box Car
Inside length	40 ft. 6 1/16 in.	40 ft. 6 in.	40 ft. 6 in.
Inside width	8 ft. 11 9/16 in.	8 ft. 9 in.	8 ft. 9 1/8 in.
Inside height	9 ft. 4 1/8 in.	9 ft. 4 in.	8 ft. 7 3/8 in.
Cubic capacity	3,384 cu. ft.	3,311 cu. ft.	3,056 cu. ft.
Load limit	134,800 lb.	124,600 lb.	123,000 lb.
Body weight	20,240 lb.	28,560 lb.	.....
Truck weight	13,960 lb.	15,840 lb.	.....
Total light weight	34,200 lb.	44,400 lb.	46,000 lb.
Maximum rail load	169,000 lb.	169,000 lb.	169,000 lb.
Ratio A.A.R. load limit to maximum rail load	79.8 per cent	73.7 per cent	72.8 per cent

Interior of the finished car ready for service

The floor stringers, two per car, extending lengthwise between the bolsters, are made of 3/32-in. plate pressed into a 3-in. Z-bar, spliced at and welded to the first crossbearer toward the end of the car. The floor beams and crossbearers are depressed in order to support the floor stringers and permit them to extend continuously from bolster to bolster without the use of intermediate brackets. At the bolster, the floor stringers are attached to the bolster top plate by 3/16-in. pressed Z-shape gussets.

The car floor is made of 1¼-in. by 5/16-in., tongue-and-groove, long-leaf yellow pine, bolted directly to the side sills and floor stringers with ½-in. Water-Tight bolts.

Edgewater ring-spring type B-32-KA draft gears are applied, using a 2¼-in. follower at each end of the gear

Partial List of Specialties on Pullman-Standard Light Weight Box Car

Cor-Ten steel sheets and shapes	Illinois Steel Company, Chicago
Air brakes, AB 10 by 12	Westinghouse Air Brake Company, Wilmerding, Pa.
Draft gears, B-32-KA ring spring	Edgewater Steel Company, Pittsburgh, Pa.
Hand brakes, light weight	Equipment Specialties Company, Chicago
Alloy-steel couplers and yokes	National Mall. & Steel Castings Co., Cleveland, Ohio
Body brake levers, drop-forged	Schaefer Equipment Company, Pittsburgh, Pa.
Doors and fixtures, journal wedges, chilled-tread wheels	Pullman-Standard Car Mfg. Co., Chicago
Water-Tight bolts	MacLean-Fogg Lock Nut Company, Chicago
Axles, A.A.R. standard	Standard Forgings Company, Chicago
Alloy-steel truck castings	American Steel Foundries, Chicago
Brake beams and supports	Chicago Railway Equipment Company, Chicago
Brakes shoes	American Brake Shoe & Fdry. Co., New York
Journal bearings	The Orme Company, Chicago
Journal-box lids and truck springs	American Locomotive Company (Railway Steel-Spring Division), New York
Bottom rod guards, Universal-type	Chicago Railway Equipment Company, Chicago
Brake-beam hangers, truck levers, hanger wear plates and bottom connections	Schaefer Equipment Company, Pittsburgh, Pa.

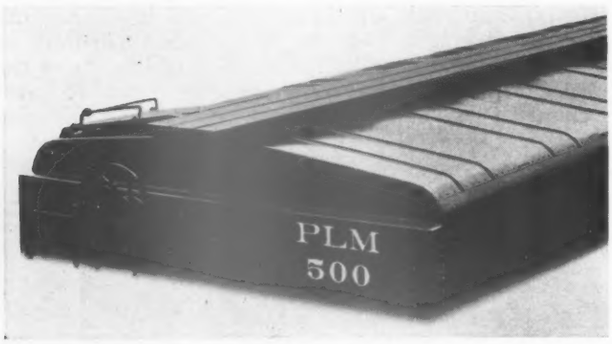
to accommodate the 24⅝-in. draft-gear pocket. The draft gear carriers, two per car, are made of 8-in. by ⅝-in. open-hearth steel secured to each center-sill flange with button-head rivets.

Type-E couplers, furnished by the National Malleable & Steel Castings Co., have 6¼-in. by 8-in. shanks and are made of high-tensile cast steel to provide light weight. The high-tensile cast-steel coupler yokes are of the vertical type and light-weight design. The coupler keys, 6-in. by 1½-in. in section, with half-round edges, are held in place with A.A.R. standard T-head pins. The coupler release rigging is of the Pullman-Standard rotary bottom-operating type

The Side and End Construction

The side plates, two per car, are built up of ⅛-in. and 3/32-in. plates, pressed to form a rounding corner for the eaves of the roof. Each side sill is a 6-in. by 3½-in. pressed angle extending the full length of the car. The side sill reinforcements, of which there are two per car, are placed at the doorways and are made of 7/32-in. plate pressed channel sections 16 ft. 4 in. long.

The side posts, 16 per car, are 3-in. deep Z-bars, pressed from ⅛-in. plate, spot and arc-welded to the



The roof construction.

side sills and the side plates. The door posts, four per car, are made of 5/32-in. pressed channels, 3 in. deep. Door post fillers, to which lining and grain door strips are nailed, are made of fir. Each corner post is built up of two ⅛-in. plates forming a box section. The outer portion of the post is a pressed angle, the inner part being pressed diagonally to the two outer toes of the outside angle, and the side and end sheets being sandwiched between the two parts of the post.

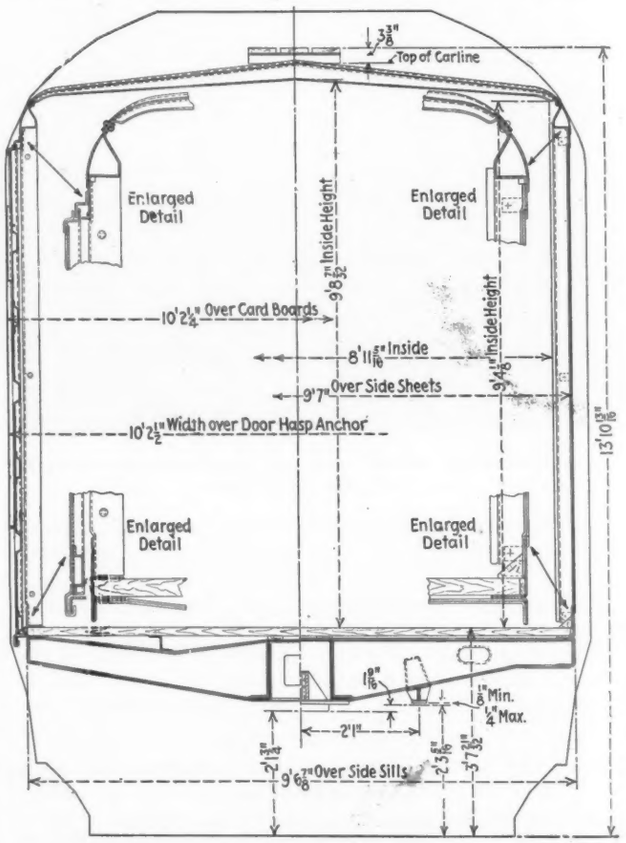
The end posts, six per car, made of ⅛-in. pressed channels, are flanged to bear against and spot-welded to the end sheets. Each end post is also arc-welded to the end sill and end plate. The end post is reinforced at the bottom by ⅛-in. pressed channels spot-welded to the post for a distance of approximately 3 ft. from the bottom of the post.

The side sheets, of which there are 20 per car, are .05-in. sheets, each pressed with two ½-in. deep corrugations extending vertically from side plate to sill. The side sheets are spot-welded to the side plate, posts and sill. The side and end sheets are secured to the corner post construction with ⅜-in. button-head rivets. The side and end lining nailers at the corner posts are fir, each bolted with clips which are in turn riveted to the corner post. The side lining, 25/32-in. by 5 3/16-in. tongue-and-groove fir, extends from 1½ in. above the floor to the side plate and is nailed to the vertical furrings bolted to three clips welded to the side plate, side sill and side sheet.

The door sheets are .05 in. thick. There are three sheets per door. The bottom and middle sheets are corrugated along the top edge, with the bottom of the middle and top sheets extending over this corrugation and forming a box section. Each sheet also has an intermediate corrugation, providing in all three open corrugations per door and two intermediate boxed sections. The door, complete with top and bottom rails and rollers, weighs 180 lb., which may be compared with 352 lb. for the C. G. W. car door, made of .10-in open-hearth steel.

The top end sheets are of 3/32-in. plate pressed at the top to form an integral end plate and sheared along the top edge to follow the contour of the roof. The bottom edge of the top sheet offsets and laps the bottom sheet ¾ in., being spot-welded to it and thus forming a horizontal seam across the end of the car. The bottom end sheets are of ⅛-in. plate, extending from side to side of the car and spot-welded to the vertical leg of the end sill.

The end lining is of 25/32-in. by 5 3/16-in. tongue-and-



Cross-section showing inside width 2 5/16 in. greater than standard

groove fir, extending horizontally from side to side of the car from the top of the floor to the bottom of the end plate. The lining is nailed to the corner post fillers and to two vertical intermediate furrings which are bolted to ⅛-in. pressed clips riveted to the end sheets.

Details of the Roof Construction

The carlines, 11 per car, are 3/32-in. pressed channel sections, extending from side to side and secured to the side plates with button-head rivets. The door-post carline and the third carline from the end are further connected to the side plate with 3/32-in. pressed reinforcements arc-welded in place.

The intermediate roof sheets, 10 per car, are .05 in.

thick, spot-welded to the carlines and secured to the side plate with ⅜-in. button-head rivets. The roof sheet at each end of the car is spot-welded to the carline and secured to the side plate and to the end plate with button-head rivets. Each roof sheet has two corrugations, ½ in. deep over-all, extending from side to side of the car.

Westinghouse Type-AB air brake equipment is installed, being the regular 10-in. by 12-in. schedule with the exception that the reservoir is pressed steel. The train line is 1¼-in. standard-weight butt-welded black steel pipe with extra-heavy end nipples. The pipe connecting the AB valve and the reservoir is ¾-in. standard black steel pipe. The retainer pipe also is black steel pipe. The car is braked to 75 per cent of its light weight, based on 50 lb. per sq. in. cylinder pressure. The Equipco hand brakes are of the vertical-wheel geared-type with aluminum housing. The brake badge plate is of aluminum, applied to the center sill near the cylinder. The brake rods, pins and levers are of conventional design, cylinder supports, reservoir supports, AB valve supports, brake rod guides being of lightweight design.

Safety Appliances and Trucks

The ladder treads and grab irons are of $^{21}/_{32}$-in. round open-hearth steel. The grab irons are secured to ⅛-in pressed brackets with ½-in. rivets, which in turn are securely riveted to the side and end sheets with ⅜-in. rivets suitably backed up with reinforcing plates to form a firm anchorage. Ladder treads are straight plain rungs extending into the pressed channel ladder stile and welded in place inside the inner flange of the channel. The ladder stiles are formed of $^{3}/_{32}$-in. steel channel section flared out at the top and bottom and formed to provide integral attachment to the car without the use of separate brackets. The sill steps are of a pressed channel section, $^{3}/_{16}$-in. material, flattened at the end and bent over to form feet for riveting direct to the under side of the side sill. The sill steps are secured with ⅝-in. rivets.

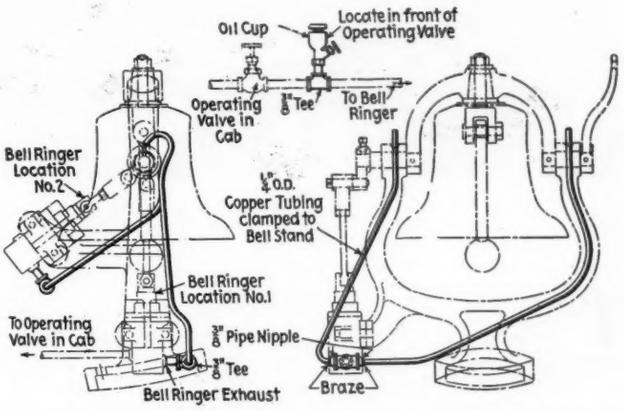
The longitudinal running board is three boards wide, extending the full length of the car with spliced joints staggered and secured to the pressed angle running board saddles with ⅜-in. Water-Tight bolts. The latitudinal running board consists of seven boards, 5¾-in. by 1⅛-in. long-leaf yellow pine, secured to pressed brackets with ⅜-in. Water-Tight bolts. The latitudinal running board bracket is a pressed Z-shape with the end at the side plate flared out and riveted to the roof sheet, which is reinforced on the inside by a gusset which rivets to the side plate and the roof sheet joint.

The car trucks are of the double-truss, spring-plankless type. Especially-shaped surfaces in the bolster and column connection provide proper engaging areas and self-alinement without the use of the spring plank. The truck side frames and bolsters, furnished by the American Steel Foundries, are of light-weight design and made of manganese-vanadium steel, double-normalized, conforming to proposed A.A.R. requirements for lightweight trucks. Creco all-steel brake beams, furnished by the Chicago Railway Equipment Company, are also of special light design, but conform in interchange and capacity to requirements for A.A.R. No. 15 brake beams. The Creco fourth-point supports are attached to the side frames. Coil elliptic springs are used. Pullman-Standard chilled-tread car wheels are a light design, weighing only 665 lb. per wheel. A.A.R. standard carbon steel axles are applied with 5½-in. by 10-in. journals.

Lubricating Device For Bell Ringer

BELL ringers are always subject to more or less trouble due to the lack of lubrication at the trunnion points. Even though the bell trunnions may be well lubricated before the locomotive leaves the terminal, it is frequently found at the conclusion of the trip that the bell will not ring because the oil has either become solidified in cold weather or has flowed away in warm weather. In addition, the oil holes in the trunnion bushings are often found to be plugged up or filled with cinders.

With the arrangement shown, which was designed by Frank L. Staley and is in use on an eastern railroad, it is possible for the engineman to lubricate the bell ringer cylinder and the trunnion bushings while the locomotive is in motion and without leaving his usual position in the cab. In addition to this feature the application does away with the necessity of climbing to the top of the boiler at any time in order to apply lubrication.



Staley method of lubricating bell ringer and bell shaft

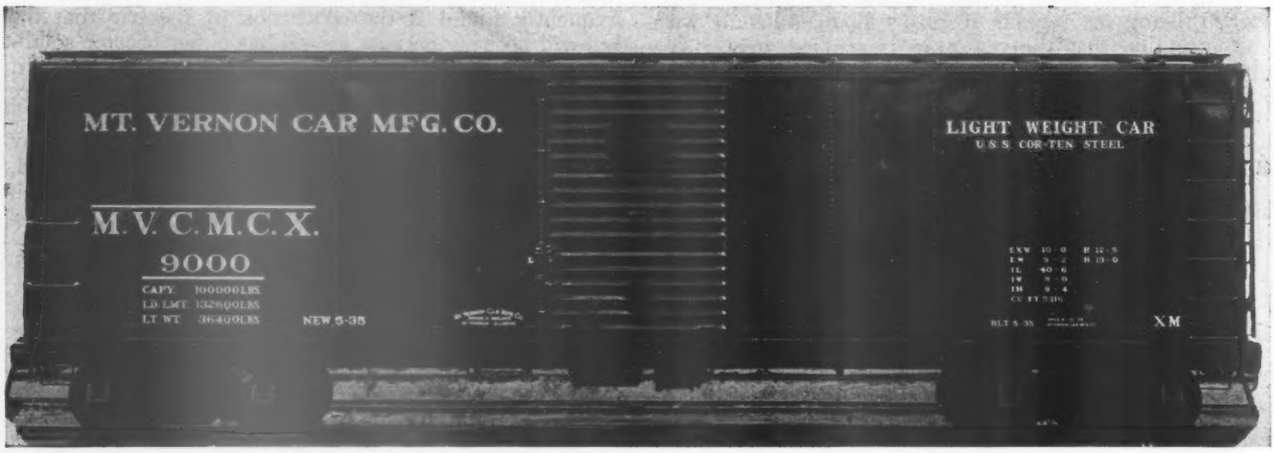
The arrangement, which has been patented in the United States and Canada, employs a combined air-pressure valve and a specially designed oil cup which is located in the cab, the valve and cup being placed in the air line between the operating valve and the bell ringer as shown in the drawing. From the exhaust port on the bell ringer cylinder there are two small exhaust pipes running to the bell trunnions and into which the lubrication is forced.

In operation, as the air valve is opened, the oil feed is also opened at the same time. The oil then becomes atomized and is carried along with the air to the inside of the bell ringer and then exhausted directly to the trunnion bushing oil holes. This arrangement not only prolongs the life of the bell ringer cylinder itself, but also the trunnion bushings.

On modern locomotives the air line to the bell ringer is usually carried underneath the jacket and, as a consequence, this line is kept warm. The Staley device takes advantage of this location of the air line, using the heated air and atomized oil to keep the bell trunions thawed out and properly lubricated in the coldest weather.

FARE ENOUGH.—Rulers are now part of the equipment of Chinese railway conductors. A new order provides that children shall be paid for by the foot. Those under 2 ft. 6 in. ride free, those between that height and 4 ft. 4 in. pay half fare, and taller ones are classed as adults. On this basis, a considerable saving in railway fares could be effected by a troupe of midgets.

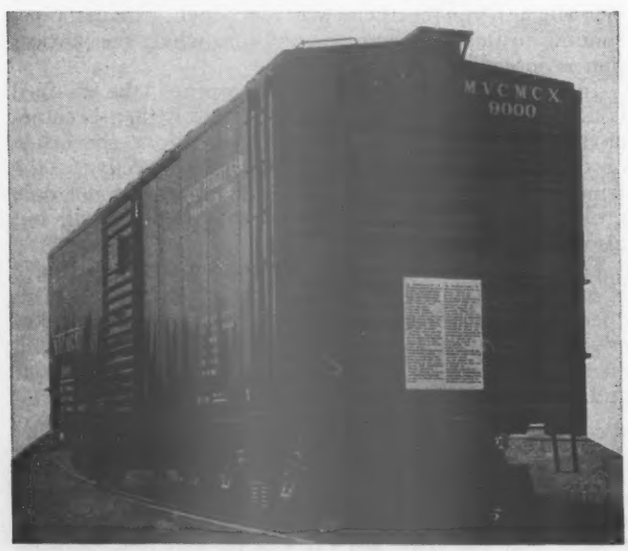
Light-Weight Box Car Built by Mt. Vernon



Mt. Vernon 50-ton light-weight box car built of Cor-Ten

THE Mt. Vernon Car Manufacturing Company has recently completed a light-weight 50-ton steel-sheathed box car along conventional lines of the A. A. R. 1932 design, except that Cor-Ten steel is substituted for the nearest practical approximate section in strength and high-tensile steel castings have been used in couplers and coupler yokes. The auxiliary reservoir and the single-strength train pipe also are made of Cor-Ten steel.

On the trucks, high-tensile cast-steel side frames and truck bolsters are used, also light-weight brake beams and light cast-iron specially-annealed wheels weighing approximately 665 lb. each. The weight of the trucks is 13,660 lb., a saving of about 2,040 lb. per car. The light weight of the car is 36,400 lb., which represents a saving of 7,900 lb.



An end view of the car

The use of alloy steel makes it possible to effect a 7,900-lb. saving over the 1932 A. A. R. design of conventional 50-ton box car — Light weight of car is 36,400 lb.

The greater portion of this reduction is due to the use of Cor-Ten or similar alloy steel. The underframe and superframe are built of Cor-Ten steel plates, sheets, shapes and bars throughout, 9,716 lb. of alloy steel replacing 13,395 lb. of plain carbon steel, making a saving of 3,679 lb., or 27.5 per cent on structurals.

There is a further reduction by the use of Cor-Ten or similar alloy steel on the following specialties: Air brakes, Cor-Ten steel reservoir, Dreadnaught ends, Murphy improved solid steel roof, Cor-Ten single-strength train pipe, rivets and bolts, Youngstown corrugated doors and Camel door fixtures. This brings a total saving on account of alloy rolled steel up to 5,410 lb., or 26.8 per cent. The use of high-tensile cast steel for the body center plates, couplers, coupler yokes, truck bolsters and truck side frames effected a saving of 1,064 lb., or 19.5 per cent.

There was a further reduction of 1,426 lb. due to using special material or design for the following items: 33-in. light-weight cast-iron annealed wheels, 665 lb. each; light-weight Creco brake beams; coupler centering device; journal bearings and elimination of the spring plank. The federal co-ordinator's recent survey of cars for pooling shows that all of the steel box cars built by car builders from 1920 to 1934, inclusive, average 46,500 lb. This Mount Vernon car is 10,100 lb. lighter than the average steel-sheathed car of this type in existence at this time. It is 7,900 lb. lighter than

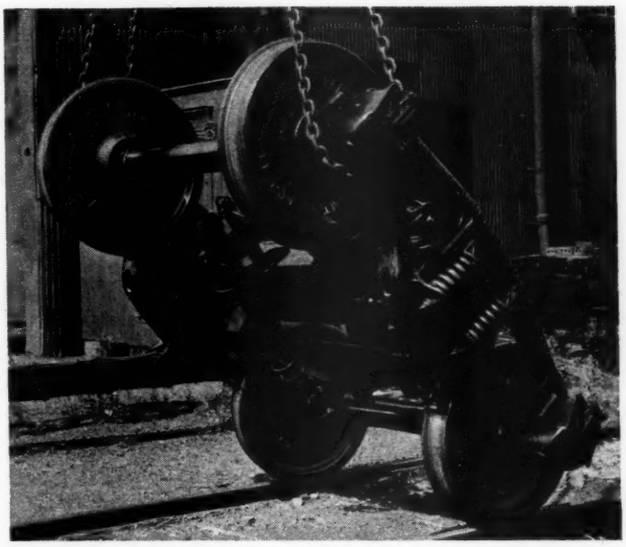
the A. A. R. 1932 design of steel-sheathed car.

In producing this car, all existing A. A. R. standard details were observed throughout and all general dimensions of the car were held without change. The various sections were scaled down in thickness and sizes to the approximate equivalent strength to the original details of the car. In some cases, it was necessary to substitute pressed shapes for rolled sections.

The Mt. Vernon box car is 44 ft. 2½ in. long between coupler pulling faces, 41 ft. 8¼ in. over striking castings and 30 ft. 8½ in. between truck centers. Its extreme width is 9 ft. 11⅛ in. and height 13 ft. 10¼ in. With clear inside dimensions of 40 ft. 6 1/16 in. long by 8 ft. 9¼ in. wide by 9 ft. 4 in. high, the car has a capacity of 3,316 cu. ft. The nominal weight-carrying capacity of the car is 50 tons, but the load limit is 132,600 lb. The actual and percentage weight savings as the result of using Cor-Ten steel plates and shapes, alloy cast-steel parts and other special light-weight parts are shown separately and in total in the table.

Weight Savings as a Result of Using (A) Cor-Ten Steel Plates and Shapes; (B) Alloy Cast-Steel Specialties; and (C) Other Specialties of Light-Weight Design

	Weight per car, lb.		Saving in weight	
	Conventional type	Alloy-Steel type	Lb.	Per Cent
A—Specialties Reduced in Weight By Using Cor-Ten Steel:				
Air brakes—Westinghouse Type-AB, with alloy steel reservoir	671.5	509.5	162.0	24.1
Doors—Youngstown corrugated type with Camel roller lift side-door fixtures, furnished by Camel Sales Company	1,532.0	1,173.0	359.0	23.4
Ends—Dreadnaught two-section type, furnished by Union Metal Products Co.	2,000.0	1,500.0	500.0	25.0
Journal-box lids—Asco, pressed type, furnished by Allegheny Steel Company	47.6	37.8	9.8	20.6
Train-line pipe, steel, furnished by National Tube Company	149.8	113.6	36.2	24.2
Roof—Murphy solid-steel type, furnished by Standard Railway Equipment Company	1,742.0	1,260.0	482.0	27.7
Steel—Structurals, plates and bars, furnished by Illinois Steel Co., sheets by American Sheet & Tin Plate Co.				
Plates, sheets and structurals	9,607.0	6,787.0	2,820.0	29.4
Z-center sills	2,966.0	2,381.0	585.0	19.7
Bars	822.0	548.0	274.0	33.3
Additional miscellaneous items, such as follower plates, draft keys, grab irons, etc., that could not be changed in weight 796.7 lb.				
Small rivets ⅜ in. and ½ in. dia. Cor-Ten, furnished by Gary Screw & Bolt Co.	None	174.0	....	...
Cor-Ten rivets ⅝ in. dia. made by car builder	None	170.0	....	...
Plain rivets	550.0	73.0	133.0	24.2
Bolts—Lewis Seal-Tite Cor-Ten, ⅜ in. dia. for running boards and floor, furnished by Lewis Bolt & Nut Co.	None	32.0	....	...
Plain steel bolts	108.0	27.0	49.0	45.4
Total saving by use of Cor-Ten steel	20,196.0	14,786.0	5,410.0	26.8
B—Specialties Reduced in Weight By Using Alloy Cast Steel:				
Body center plate, A.A.R. design modified	160.0	114.0	46.0	28.8
Couplers—A.A.R. Type-E, 6¼-in. by 8-in. shank, rotary bottom operating	890.0	698.0	192.0	21.6
Coupler yokes, A.A.R. vertical type	420.0	294.0	126.0	30.0
Truck bolsters—Double-truss, self-alining	1,596.0	1,222.0	374.0	23.4
Truck side frames—5½-in. by 10-in. integral box, double-truss, self-alining spring plankless type	2,390.0	2,064.0	326.0	13.6
Total saving by use of alloy cast steel	5,456.0	4,392.0	1,064.0	19.5
C—Specialties Reduced in Weight By Using Special Material or Design:				
Wheels—33-in. light-weight single-plate cast iron annealed	6,000.0	5,320.0	680.0	11.3
Brake beams—Creco special light-weight furnished by Chicago Railway Equipment Company	396.0	284.0	112.0	28.3
Coupler centering device—Union-type, made of high-tensile malleable iron, by the Union Metal Products Company	67.0	60.0	7.0	10.4
Journal bearings—Arctic No. 36 bronze, furnished by National Bearing Metals Corp.	206.0	200.0	6.0	3.0
Spring plank—Steel plate not used on Cor-Ten car	396.0	None	396.0	100.0
Miscellaneous	225.0	None	225.0	100.0
Total saving by use of special materials	7,290.0	5,864.0	1,426.0	19.6
Grand total (A. B. and C. Specialties)	32,942.0	25,042.0	7,900.0	24.0



The high-tensile truck is of the spring-plankless design

Other Standard Specialties Used on the Mt. Vernon Light-Weight Box Car

Bottom rod guards—Creco, Universal type	Chicago Railway Equipment Co., Chicago
Brake-beam supports and safety device—Creco type	Chicago Railway Equipment Co., Chicago
Brake-beam hanger retainers—Mobile Type A	Illinois Railway Equipment Co., Chicago
Brake shoes—A.A.R. cast iron, steel reinforced	
Brake step—Viloco pressed type	Viloco Railway Equipment Co., Chicago
Draft gear—Class A-22-XB	W. H. Miner, Inc., Chicago
Grip nuts	Grip Nut Co., Chicago
Hand brakes—High-power, vertical-wheel type	Equipment Specialties Co., Chicago
Hand-brake chain	Nixdorf-Krein Mfg. Co., St. Louis, Mo.
Train-line pipe clamp—Lock-Tite	Lox-On Corp., New York
Pipe clamps for ¾-in. retainer pipe	Illinois Railway Equipment Co., Chicago
Striking casting and front draft lugs combined	Burnside Steel Foundry Co., Chicago
Truck side bearings—Roller type	A. Stucki Co., Pittsburgh, Pa.
Truck springs—Outer coils only	American Locomotive Company (Railway Steel Spring Div.), New York
Truck-spring plates	Geometric Stamping Co., Cleveland, Ohio
Uncoupling rigging—Imperial rotary-type	Union Metal Products Co., Chicago

More Nicknames.—One anonymous correspondent in Atlanta, unidentifiable except that he has a telegrapher's "fist," has sent in some 30 or 40 railroad nicknames. His latest batch includes:

Detroit & Mackinac—Defeated & Maltreated.

Atlantic Coast Line—Atlantic Clothes Line.

Bangor & Aroostook—Bang-up & Arrogant.

Boston & Albany—Before and After.

New Orleans & North Eastern—No Omelettes & No Eggs.

Carolina, Clinchfield & Ohio—Corn, Cotton & Oats.

West Virginia Central & Pittsburgh—Watch Very Carefully & Proceed.

Colorado & Wyoming—Carpenter & Walrus.

Among the Clubs and Associations

AMERICAN WELDING SOCIETY. — The American Welding Society will hold its fifteenth fall meeting in Chicago, Ill., September 30-October 4. Meetings of the society will be held in the Palmer House, State and Monroe streets.

EASTERN CAR FOREMAN'S ASSOCIATION. —The annual golf tournament and field outing of the Eastern Car Foreman's Association will be held at the Race Brook Country Club, New Haven, Conn., on Thursday, July 18. The program will include golf and field events.

NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION.—The member companies of the National Machine Tool Builders' Association are planning what is expected to be the largest exhibit of modern machine tools and accessories ever held. The Machine Tool Show will be held at the new Public Auditorium, Cleveland, Ohio, September 11 to 21.

P. & S. DIVISION.—Arrangements for the annual meeting of the Purchases and Stores Division, A. A. R., have been completed by the General Committee. The meetings will be held at the Palmer House, Chicago, on Tuesday and Wednesday, July 23 and 24, the sessions convening at 10 a. m. Central daylight-saving time. The chairmen and members of subject committees are expected to be present and representatives of all member roads are invited to attend and participate in the discussions. The meeting will be confined to the presentation of completed committee recommendations and other business matters. No exhibits or entertainment features will be provided.

NEW YORK RAILROAD CLUB.—Less regulation and lower taxation for the railways, and not more of each for their competitors, is the prescription for railway ills favored by Alfred E. Smith, former governor of New York. This view he expressed in an informal speech at a dinner following the outing of the New York Railroad Club at the Westchester Country Club, Rye, N. Y., on June 20. ¶"If I had a boy who wanted to go into railroad work," declared the former standard bearer of the Democratic Party, "I would advise him against it. If he had brains and initiative, he could not get anywhere with them with Interstate Commerce Commission regulation. ¶"The government cannot do business well. It is not organized to do it. As a matter of fact, the government doesn't do its own business very well. If some of us here would get together and take over the postal service, we could probably make money out of it instead of incurring deficits as the government is doing. ¶"Railroads need not be afraid of the march of progress in transportation. The development of new agencies has rendered some of their branch lines obsolete, and these should be abandoned, but the time will not come in our life time when the railroads will not be the main arteries of our national transportation system." ¶Attendance at the New York Railroad Club outing totaled 750. Most of those in attendance played golf through the day, and other diversions were provided for those who did not. The Western Union Telegraph Company's golf team won the custody of the Herbert H. Vreeland trophy. The Brady cup was won by C. E. Simmons, Jr. Watts Gunn, of the Western Union Telegraph Company, won the low gross award in class A, with a score of 78; L. G. Sullivan, with 88, won class B; and P. R. Kellar, with 98, won class C. H. L. Wetherwax, vice-president of the United Traction Lines, Albany, N. Y., won the low gross for the guests with 75. R. D. Starbuck, executive vice-president of the New York Central, won the "kickers' handicap."

Directory

The following list gives names of secretaries, dates of next regular meetings and places of meetings of mechanical associations and railroad clubs:

AIR-BRAKE ASSOCIATION.—T. L. Burton, c/o Westinghouse Air Brake Company, Thirty-fourth Floor, Empire State Building, New York.

ALLIED RAILWAY SUPPLY ASSOCIATION.—F. W. Venton, Crane Company, Chicago.

ASSOCIATION OF AMERICAN RAILROADS. — J. R. Downes, vice-president operations and maintenance department, Transportation Building, Washington, D. C.

DIVISION I. — OPERATING. — SAFETY SECTION.—J. C. Caviston, 30 Vesey street, New York.

DIVISION V.—MECHANICAL.—V. R. Hawthorne, 59 East Van Buren street, Chicago.

COMMITTEE ON RESEARCH.—H. A. Johnson, chairman (Director of Research, Association of American Railroads), Chicago.

DIVISION VI.—PURCHASE AND STORES.—W. J. Farrell, 30 Vesey street, New York.

DIVISION VIII.—MOTOR TRANSPORT.—CAR SERVICE DIVISION.—C. A. Buch, Transportation Building, Washington, D. C.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—G. G. Macina, 11402 Calumet avenue, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—C. E. Davies, 29 West Thirty-ninth street, New York.

RAILROAD DIVISION.—Marion B. Richardson, 192 East Cedar street, Livingston, N. J. Next meeting, Cincinnati, Ohio, June, 1935.

MACHINE SHOP PRACTICE DIVISION.—G. F. Nordenholt, 330 West Forty-second street, New York.

MATERIALS HANDLING DIVISION. — M. W. Potts, Alvey-Ferguson Company, 1440 Broadway, New York.

OIL AND GAS POWER DIVISION. — M. J. Reed, 2 West Forty-fifth street, New York.

FUELS DIVISION.—W. G. Christy, Department of Health Regulation, Court House, Jersey City, N. J.

CAR DEPARTMENT OFFICERS ASSOCIATION.—A. S. Sternberg, master car builder, Belt Railway of Chicago, 7926 South Morgan street, Chicago.

INTERNATIONAL RAILWAY FUEL ASSOCIATION. — T. D. Smith, 1660 Old Colony Building, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 West Wabasha street, Winona, Minn.

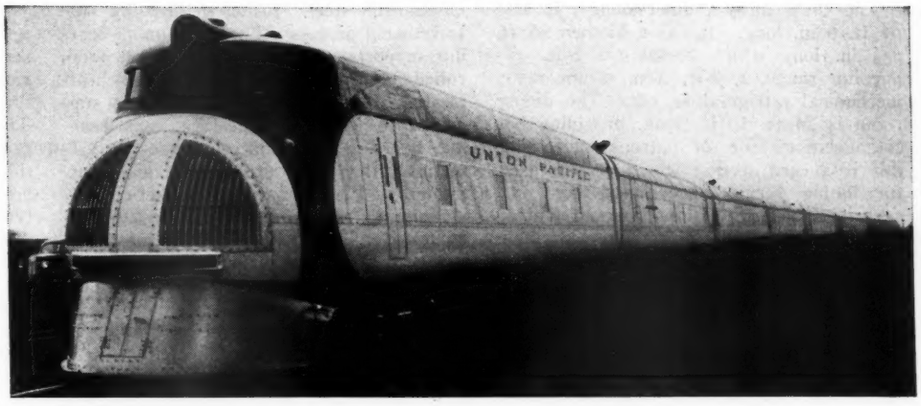
INTERNATIONAL RAILWAY MASTER BLACKSMITHS' ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark avenue, Detroit, Mich.

MASTER BOILERMAKERS' ASSOCIATION.—A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y.

TRAVELING ENGINEERS' ASSOCIATION. — W. O. Thompson, 1177 East Ninety-eighth street, Cleveland, Ohio.

* * * *

New York Chapter, Railway and Locomotive Historical Society, at the Colonie Shops of the Delaware & Hudson
The D. & H. motive power staff acted as guides to sixty members of the New York Chapter of the Society who visited the Colonie shops on Sunday, June 16



The Union Pacific M-10001 ready for service with 1,200 hp. Diesel-electric power plant and new dining and lounge facilities

NEWS

PUBLIC WORKS ADMINISTRATION has allotted $1,040,000 to the Norfolk Southern for the acquisition of 500 steel box cars, at an estimated cost of $1,155,000. The railroad will supply the balance above the PWA loan.

Air-Conditioned Local Train Placed in Service on B. & O.

A THREE-CAR train, powered by two Diesel-electric motors of 300 hp. each, started regular service June 3 on the Baltimore & Ohio, making three round trips a day between Baltimore, Md., and Washington, D. C. All the cars have been newly upholstered and it is believed that this is the first fully air-conditioned train put into local service on any railroad.

The engines are housed in the forward part of the first car, the balance of which is given over to a smoking compartment, with chairs upholstered in leather. The other two cars are of the standard individual seat B. & O. type, with modern color treatment and linen headrests on the seats. This train is not to be confused with the new light-weight, high-speed train which will shortly be placed in service on the B. & O. between Washington and New York, and for which the B. & O. will soon have an 1,800 hp. Diesel-electric locomotive.

Fourth Car Added to Original Zephyr

A FOURTH car has been added to the original Zephyr of the C., B. & Q., the train making its first trip between Lincoln, Neb., and Kansas City, Mo., as a four-car train on June 24. The addition of the fourth car increases the capacity from 72 to 112 seats. An inspection of the train, conducted by officers of the Burlington, the General Motors Corp. and the Budd Manufacturing Co., showed that not a single part had worn perceptibly. The train had traveled 138,937 miles, of which 100,000 had been run since November 11, when the train was placed in daily service.

The first Zephyr, during its more than seven months' performance, has shown an increase in passenger traffic of 136 per cent, as contrasted with the two steam trains it supplanted. The popularity of the streamliner is emphasized by the contrast of this high percentage with the 18 per cent increase in passenger travel over the entire system. The average number of passengers per day in each direction from November 11 to June 19 has been slightly over 100, the southbound trip with 106.8 showing a little better than the northbound service of 100.6. The average per diem patronage from one terminal to another has been as high as 121 and as low as 89, although the seating capacity prior to the insertion of the new car was limited to 72.

The cost of operation and maintenance on this 500-mile run during the intervening 217 days has been approximately 35 cents per mile, as compared with a cost of 65 cents per mile with the previous steam equipment.

The original three-car train was described in the May, 1934, *Railway Mechanical Engineer*.

St. L.-S. F. Freight Cars—A Correction

IN connection with the application of wood floors to the St. Louis-San Francisco box and gondola cars, described in the June *Railway Mechanical Engineer*, page 250, Grip Nut Leak-Proof bolts were not used exclusively as implied in the article, the floor bolts on a large number of the cars being of the M-F Water-Tight type furnished by the MacLean-Fogg Lock Nut Company.

Union Pacific Seven-Unit Articulated Train

THE "City of Portland," the new Union Pacific seven-car articulated train placed in service on June 6 between Chicago and Portland, Ore., carried 4,968 persons during the first 11 days of its operation. The train operates on a 39¾-hr. schedule, averaging 57.1 m.p.h. for the 2,272 miles, including 12 stops. Speeds up to and over 83 m.p.h. are required to maintain this schedule.

The train, of aluminum alloy construction, consists of seven articulated body units having a total length of 454 ft. 11 in. and weighing 265 tons light, or 296 tons fully loaded. The seating capacity is 118, exclusive of the diner-lounge, which seats 39, bringing the total passenger-carrying capacity of the train up to 157. The train, built by the Pullman-Standard Car Manufacturing Company, differs in several respects from the M-10001 described in the November, 1934, *Railway Mechanical Engineer*. Its power car has been enlarged and the power plant increased from 900 hp. to 1,200 hp. A diner-lounge car has been added to the train. New trucks, of special design, incorporating welded steel construction, have been installed. Brakes, furnished by the New York Air Brake Company, include the Decelekron device designed to provide continuous maximum braking pressure without wheel locking or sliding. Dual Vapor steam boilers and steam heating, in conjunction with preheated air in the air-conditioning apparatus, have replaced the original system and one air-conditioning system for each body unit has been substituted for the two-car system. Each heating boiler has a capacity of 800 lb. of steam per hour, burns the same fuel as that used in the main Diesel engine and weighs only 1,100 lb. Steam pressures up to 125 lb. are available.

The first body unit of the revamped train, which is devoted entirely to the power plant and auxiliaries, is 60 ft. 3 in. long to the center of the first articulation. The body and underframe are a complete unit, made of strong aluminum alloys and having a removable bottom designed to allow lifting the entire body off of the engine and generator with minimum labor.

The second, a mail and baggage unit, is 64 ft. 6 in. between articulations, having a 33-ft. post-office compartment with an 8-ft. boiler compartment forward of the mail apartment. The balance of the floor plan comprises the baggage compartment which contains the boiler water supply tank, air-conditioning compartment for the following diner-lounge unit, and toilet, lavatory and linen locker facilities for the kitchen crew.

(Continued on next left-hand page)

The third unit, a diner-lounge, is also 64 ft. 6 in. long. It has a kitchen 16 ft. 5⅜ in. long which contains a 5-ft. oil-burning range, a 3-ft. 3-in. steam table, mechanical refrigerators, etc. The dining room is 24 ft. 10 in. long, providing accommodations for 24 patrons; adjoining this is a card section which is also used for dining service, accommodating six; next is a 14-ft. 8-in. lounge room with a built-in desk, end table, nine portable metal chairs, stationery and periodical receptacles and built-in radio.

The fourth, fifth and sixth units are Pullman sleepers, developed especially for the U. P. streamlined trains. Each is 64 ft. 6 in. long. The fourth and sixth, called the "Oregon Trail" and the "Overland Trail," have eight sections, one compartment and one bedroom in each. The fifth body unit, called the "Abraham Lincoln," has ten sections, one compartment and one bedroom. Two sections on each Pullman unit are equipped with berths 6 in. longer than the present standard of 72¾ in. Sliding aluminum panels make each berth, in effect, a small compartment. The seventh, or rear unit of the train, is 72 ft. 2 in. long and has reclining seats to accommodate 54 passengers, with buffet in the rear end for serving light meals to passengers in their seats.

All of the trucks, designed especially for use on this train by engineers of the Union Pacific and Pullman-Standard Car Manufacturing Company, are of the four-wheel type with welded frames of Cor-Ten steel. The first two are motor trucks with 8-ft. 4-in. wheel base. The balance of the trucks are trailer type with 8-ft. 3½-in. wheel base. The motor trucks are of the equalizer type. The trailer trucks are designed with three groups of springs having main and intermediate bolster springs, and rubber discs and coil springs at the journal boxes. All trucks are fitted with SKF outboard roller bearings. The two motor trucks have 36-in. wheels and all of the trailer trucks have wheels 33 in. in diameter.

The exterior color scheme of the train is canary yellow on the sides and nose, and golden brown on the top and bottom. The train is thoroughly insulated and provided with a ventilating system which gives complete air change each four minutes. All windows are double and of shatterproof plate glass. Lighting throughout the train is indirect, except for the adjustable night berth reading lamps in the Pullman units.

The horsepower available for propulsion of the M-10001 originates in a Winton high-compression two-cycle Diesel engine, having 16 V-type, 8-in. by 10-in. cylinders. With a rated capacity of 1,200 hp., this is the most powerful two-cycle Diesel engine yet placed in railway passenger service. Power for all auxiliaries is taken from two auxiliary engine-driven generator sets, by Winton two-cycle engines of 110 hp. each, having 5-in. by 7-in. cylinders. The main Diesel engine is identical in design with that of the 900-hp., 12-cylinder engine in the first train, with the exception that four cylinders have been added to produce 1,200 hp. The engine is featured by a one-piece engine block, the crank case and cylinder block made of Cromansil steel, fusion-welded by the Lukenweld process. The seven main-bearing supports and caps are flame-cut from rolled plates of alloy steel. The heat-treated alloy steel crank shafts are supported in 6¾-in. bronze-face, main-bearing liners. The connecting rods are I-section, alloy steel, drop-forged and heat-treated. Pistons are a nickel-copper-aluminum alloy, operating in water-jacketed cylinder liners made of heat-treated nickel-chromium cast iron.

Each cylinder is fitted with an individual and easily removable cylinder head, made of the same material as the liners, having exhaust ports completely water-jacketed and secured to the cylinder block with heat-treated nickel steel studs. Each cylinder head is equipped with four exhaust valves, a unit fuel injector, and cylinder test and safety valve. The unit injector, one of the most distinctive parts of the engine, combines the fuel pump and the spray valve in a single compact unit, thus providing each cylinder with a complete and independent fuel injection system. The fuel oil is delivered to the injectors at the relatively low pressure of 25 lb. per sq. in. This is the pressure required to fill the injector. The operation of the pump plunger, moved through a constant stroke by the injector rocker lever, increases this pressure to the amount needed for fuel injection purposes.

The engine cam shaft is of the built-up type with the cams shrunk, keyed and set-screwed on the shaft. Pressure lubrication is furnished by an oil pump which draws returned oil from the oil-pan sump. The scavenging air is furnished by a positive displacement-type blower, with the intake air thoroughly muffled. The governor is of the self-contained hydraulic type, supplemented by an overspeed trip, driven from the two cam shafts and fitted with a shaft for connecting linkage to the cab control. A centrifugal pump for cooling water and a double-gear type for lubricating oil are driven from a helical spur-gear train at the blower end of the engine.

Untried Freight-Car Designs Require Approval of A. A. R.

INSTRUCTIONS to car owners and builders have recently been issued by the secretary of the Mechanical Division, as follows:

"'Rule 3. No car of an untried type, whether built new, altered or changed, shall be offered or accepted in interchange, nor accepted from car owner, until its size, capacity and design shall have been approved by the Transportation and Mechanical Divisions of the Association of American Railroads.'

"This rule was promulgated previous to

(Continued on next left-hand page)

New Equipment

CAR ORDERS

Purchaser	No. of cars	Type of car	Builder
Bangor & Aroostook	2	Caboose	Co. shops
Chesapeake & Ohio	2,000	Hopper	American Car and Fdry. Co.
	1,500	Hopper	Pullman-Standard Car Mfg. Co.
	1,500	Hopper	General American Car. Co.
	75	Flat	Bethlehem Steel Co.
	50	Stock	General American Car. Co.
Ethyl Gasoline Corp	15	3,000-gal tank	American Car and Fdry. Co.
	9	6,000-gal. tank	
United Carbon Co.	2	Covered hopper	American Car and Fdry. Co.

CAR INQUIRIES

Canadian Nat'l	250[1]	Refrigerator	.....
	300[1]	Gen. service	.....
	150[1]	Sand	.....
	400[1]	Automobile	.....
Canadian Pacific	750	Box	.....
	300	Coal	.....
	150	Refrigerator	.....
C. R. I. & P.	320[2]	.....	.....
Grand Trunk	150	70-ton gondola	.....
United Fruit Co.	5, 10 or 15[3]	Passenger	.....

LOCOMOTIVE ORDERS

Purchaser	No. of locos.	Type of loco.	Builder
Aliquippa & Southern	1[4]	0-8-0	American Loco. Co.
Bangor & Aroostook	2[5]	4-8-2	American Loco. Co.
Chicago & Ill. Western	1	600 hp. Diesel-elec.	American Loco. Co.

LOCOMOTIVE INQUIRIES

Chesapeake & Ohio	5	4-8-4 (with 25,000-gal. tender)	.....

MISCELLANEOUS ORDERS

Road	Type of equip.	For use on	Order placed
C. B. & Q.	Roller bearing units	Tenders of three fast freight locos.	American Steel Foundries
	Bearings and boxes	Engine trucks of four 4-8-2 locos.	Timken Roller Bearing Co.
	Bearings and boxes	All axles of Mark Twain Zephyr.	Timken Roller Bearing Co.
W. & L. E.	Bearings and boxes	Driving axles of two new 0-6-0 locos.[6]	Timken Roller Bearing Co.
	Inboard type trucks	Tenders of two new 0-6-0 locos.[6]	

[1] This is part of the construction program, the financing of which is provided for in the unemployment relief act recently passed by Parliament. In addition, 250 refrigerator cars are to be built in the railroad company's shops. The program also provides a considerable amount of repair work in the railroad's main shops, the latter to provide an additional two days' work per month for the men.

[2] For conversion from wooden box cars to stock cars.

[3] First, second or third-class, for export.

[4] This locomotive will have 25-in. by 28-in. cylinders and a total weight in working order of 231,000 lb.

[5] These locomotives will have 22½-in. by 30-in. cylinders and a total weight in working order of 315,000 lb.

[6] These two locomotives are to be built by the railroad in its Brewster, Ohio, shops.

present extensive activities on the design and construction of light-weight alloy-steel freight-equipment cars and high-tensile trucks of reduced weight.

"In view of present and probably future developments of this character, it is desired again to bring to the attention of all concerned, including railroads, car builders, truck manufacturers and others involved, the provisions of this rule and to emphasize the importance of compliance therewith in order to avoid interference with progress and the possibilities of unnecessary delays and expense.

"It is therefore urged that the Mechanical Division of the A. A. R. be given reasonable opportunity in all cases, to pass on such designs, including running-gear features which affect proper train operation, such as truck frames and bolsters, axles, wheels, brake arrangements, coupling devices and draw-gear attachments.

"To this end, proper action should be taken before such propositions have advanced to the point where commitments have been made for materials or where parts have been released for production. Unless such developments are called to the attention of the proper divisions of the A. A. R. before reaching the latter stage, necessary changes cannot then be made without incurring difficulties, such as delays and extra expenses.

"During a period of rapid change, such as the present when new materials, designs and methods are being offered for the advancement of the railroad equipment art, to which existing A. A. R. specifications may not apply, this general subject is of special importance and requires the careful attention and close co-operation of all concerned."

Precautions Needed with Arch-Bar Trucks

W. J. Patterson, director of the Bureau of Safety, I. C. C., reporting on two derailments on April 4 last, both occurring on the same road but at different places, renews the discussions and admonitions which have been made public in connection with other recent derailments, emphasizing especially the excessive costs incident to the continued use of arch-bar trucks in freight train service and the potential danger to all passenger as well as freight trains.

These derailments occurred on the C., R. I. & P., at Ottawa, Ill., and at Tiffin, Ia.

From details of the evidence, it appears that the arch-bar which failed at Tiffin was put in only the day before, and had traveled only 92 miles; it had not been properly fitted, leaving irregular stresses, and the blacksmith had done poor work; a bar not exactly the right size had been used, and other negligence was found.

At Ottawa an arch-bar truck side frame collapsed. One of the box bolts was of steel and one of iron, not conforming to standard requirements; and the failure was attributed mainly to insufficient shear resistance, and reduced capacity of springs due to wear and corrosion.

The report gives statistics of the Rock Island's freight cars and of the road's experience with this type of truck, making comparisons with similar data from the Missouri Pacific, in connection with a derailment on that road last February.

Estimating costs on the basis of the Missouri Pacific's figures, it is calculated that the Rock Island in 1934 spent $100,000 on repairs to arch-bar trucks; to which is added $21,732, the cost of 16 accidents occurring in that year; and the two derailments now reported add $56,584 to this, not including damage to lading.

These and other factors, including increases of speed of trains and heavy loads, lead to the following recommendations: (1) that arch-bar trucks be removed from service at the earliest practicable date; (2) that until such trucks can be eliminated, a reduction of at least 30 per cent should be made in the load limit of each car; and (3) that interchange rules be modified to allow a receiving road to refuse to accept these cars.

Supply Trade Notes

JOHN S. LEHMANN has been elected a member of the board of directors of the St. Louis Car Company, St. Louis, Mo., to fill the vacancy caused by the death of Sears Lehmann.

C. T. HANSEN has been appointed assistant to vice-president of the Standard Stoker Company, Inc., with headquarters at Chicago.

THE EDGCOMB STEEL COMPANY, Philadelphia, Pa., has been appointed agent of The Timken Steel & Tube Company, Canton, Ohio.

F. W. BOOSS, formerly of the Chicago office of the Gould Storage Battery Corporation, Depew, N. Y., will on July 1 take charge of the Los Angeles territory, with headquarters at 2678 Lacy street, Los Angeles, Calif.

CHARLES R. ROBINSON, vice-president in charge of railroad sales of the Inland Steel Company, Chicago, has been elected first vice-president and general manager of sales, to succeed Edward M. Adams, deceased. Mr. Robinson started his business career in 1890 as a salesman

Charles R. Robinson

of tool steel for Park Brother & Co. In 1900, he entered business for himself, handling various steel products on a brokerage basis. In 1904, he entered the employ of the Inland Steel Company as a salesman, becoming assistant general manager of sales in 1906. In October, 1908, he resigned from the Inland Steel Company to become district sales manager for the Lackawanna Steel Company at Chicago, and in 1910 was transferred to New York as general manager of sales. In the following year his headquarters were transferred to Buffalo, N. Y. He held the latter position until 1918, when he was elected vice-president in charge of sales. In January, 1922, he returned to the Inland Steel Company, coincident with that company's entrance into the rolling of standard section heavy T-rails, becoming vice-president in charge of railroad sales, which position he has held until his recent election. He became a director of the Inland Steel Company in 1924 and president of the Inland Tar Company in 1930.

H. C. HARRIGIN, vice-president and secretary of The Bird-Archer Company, of New York, is taking up new duties as vice-president of The Bird-Archer Company, Ltd., with headquarters at Montreal, Canada.

W. S. LONG, manager of mechanical sales of United States Rubber Products, Inc., with headquarters at Seattle, Wash., has been transferred to Los Angeles, Cal., and has been succeeded by C. W. Gilmer, sales representative at San Francisco, Cal. This company has moved its New Orleans, La., branch from 202 Fulton street to 440 Canal street.

HAROLD L. GIEGER has joined the field staff of the development and research department of the International Nickel Company, Inc., New York. Mr. Gieger's experience has been with the operating and metallurgical departments of the Inland Steel Company and since 1929 as chief metallurgist of the Wisconsin Steel Company—a subsidiary of International Harvester.

Obituary

J. W. CHANDLER, Louisville, Ky., representative of the Union Spring & Manufacturing Company, New Kensington, Pa., died on June 12.

E. PAYSON SMITH, president of the Illinois Railway Equipment Company, Chicago, died in that city on June 8 after an illness of several months. During the early part of his career he was employed by the Illinois Central in the transportation department and in 1905 left railroad service to enter the railway supply field as sales representative of the Standard Railway Equipment Company, Chicago. In 1911, he established his own business, engaging in the sale of industrial equipment, and in 1925 he re-entered the railway supply business, organizing the Illinois Railway Equipment Company and continuing as its president until his death.

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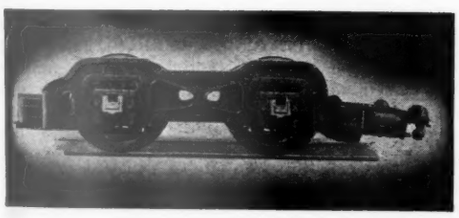
THE LOCOMOTIVE BOOSTER *Reduces* LOCOMOTIVE MAINTENANCE COSTS



In analyzing locomotive maintenance costs, many factors must be considered to make an accurate comparison.

But the fundamental factor, wear on moving parts, is proportional to the stresses involved.

These stresses, and corresponding wear, are reduced when the main cylinders provide the power needed for road speeds and the added power of The Locomotive Booster is used for starting, accelerating and over the hard spots.

By using The Locomotive Booster you can build better and cheaper instead of just bigger to gain power for a small part of the run—perhaps only 5% of the total.

Capitalize idle weight and spare steam with The Locomotive Booster and avoid needless operating fuel and maintenance expense.

Franklin parts fit—in applying them there is no labor cost for fitting. They are built to original dimensions of carefully selected materials—they avoid road failures and excessive maintenance.

FRANKLIN RAILWAY SUPPLY COMPANY, INC.

NEW YORK CHICAGO MONTREAL

Personal Mention

General

HENRY YOERG, superintendent motive power of the Great Northern, has been appointed general superintendent motive power, with headquarters as before at St. Paul, succeeding William Kelly, retired.

CHARLES J. WOLFE, master mechanic of the Western Maryland, at Hagerstown, Md., has been appointed superintendent of motive power, with the same headquarters. Mr. Wolfe was born on August 6, 1893, at Cumberland, Md., and attended the public schools of that city. He entered railway service with the Western Maryland as messenger at Ridgeley, W. Va., in June, 1905. In August, 1911, he completed apprenticeship as a machinist at the Elkins, W. Va., shops. He was transferred to the transportation department and served as a fireman and trainman until October, 1913. He was transferred to the Maryland Junction shops, Ridgeley, W. Va., and served as a leading machinist until March, 1920, when he was appointed general foreman at Bowest, Pa.; in May, 1920, he was transferred to Baltimore, Md., as general foreman in charge of terminals; in January, 1922, he was promoted to master mechanic at Baltimore, in charge of the Baltimore terminals, and in November, 1934, was transferred to Hagerstown, Md., as division master mechanic.

Charles J. Wolfe

Master Mechanics and Road Foremen

E. R. BUCK, assistant master mechanic of the Pennsylvania, has been appointed acting master mechanic, with headquarters at East Altoona, Pa.

A. PEERS, assistant superintendent motive power and car department of the Canadian Pacific at Montreal, Que., has been appointed master mechanic, with the same headquarters, succeeding C. A. Wheeler, transferred.

F. E. HOSTETLER has been appointed assistant road foreman of engines of the Middle Division of the Pennsylvania.

H. J. HASKELL, assistant road foreman of engines and assistant trainmaster of the Pennsylvania at Wilkes-Barre, Pa., has been appointed assistant road foreman of engines of the Long Island.

R. J. MACNAMARA, acting assistant road foreman of engines of the Pennsylvania at Wilkes-Barre, Pa., has been appointed assistant road foreman of engines and assistant train master.

Car Department

N. LAREAU, assistant car foreman of the Atchison, Topeka & Santa Fe at Dodge City, Kan., has been appointed car foreman, with headquarters at Hutchinson, Kan.

Purchasing and Stores

B. F. PAGE has been appointed storekeeper of the Southern at Jacksonville to succeed Mr. Logan.

E. J. BECKER, district storekeeper of the Southern Pacific, at El Paso, Tex., has been transferred to Sacramento, Calif., to replace Mr. Polk.

H. POLK, district storekeeper of the Southern Pacific at Sacramento, Cal., has been appointed assistant purchasing agent, with headquarters at Portland, Ore.

Obituary

C. B. YOUNG, who retired as consulting mechanical engineer of the Chicago, Burlington & Quincy on May 1, 1932, with headquarters at Chicago, died in that city on July 1 of paralysis. Mr. Young was born on September 25, 1865, and entered the employ of the Chicago, Burlington & Quincy in October, 1891, as a draftsman at Aurora, Ill. He was promoted to the position of chief draftsman, with headquarters at Chicago, November, 1899. In March, 1902, he became mechanical engineer and on April 2, 1918, was appointed manager of the inspection and testing service of the Division of Transportation for the Railroad Administration, with headquarters at Washington, D. C. In March, 1919, he was transferred to the staff of the Railroad Administration where he remained until June 1, 1920, when he returned to the Chicago, Burlington & Quincy as mechanical engineer. On September 6, 1927, Mr. Young was appointed consulting mechanical engineer and on May 1, 1932, retired because of ill health.

L. E. TEMPLE, mechanical engineer of the International-Great Northern, with headquarters at Palestine, Tex., died on June 21. Mr. Temple was born on December 4, 1899, and entered railway service on December 22, 1911, as a messenger for the Ft. Worth & Denver City, at Childress, Texas. Two years later he became a draftsman apprentice, and on August 1, 1918, he was made a draftsman. On January 28, 1919, he went with the International-Great Northern as chief draftsman, with headquarters at Palestine, holding this position until August 1, 1920, when he reentered the service of the Ft. Worth & Denver City as a draftsman at Childress. After a short time in the latter position he entered the service of the Baldwin Locomotive Works, Philadelphia, Pa., as detail engineer, leaving this company in 1921, to return to the International-Great Northern as assistant mechanical engineer. On May 8, 1922, Mr. Temple was promoted to mechanical engineer.

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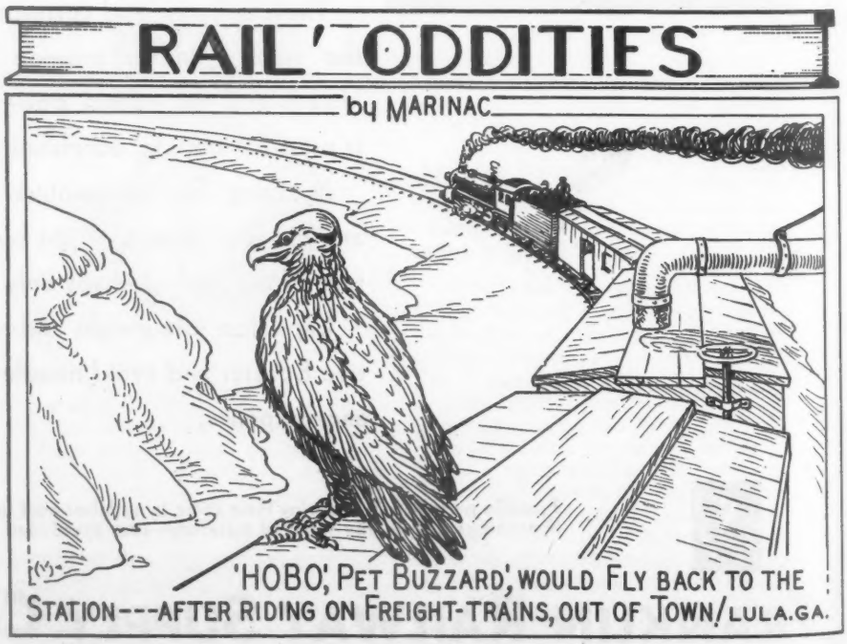

Further explanation furnished by the editor upon request